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MISSOURI'S FORESTS

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FOREWORD

This paper reports the findings of the second comprehensive forest inventory of Missouri which was taken in 1958, 1959, and 1960. The first was made in 1947. Changes in timber cutting practices and land use and management since then have altered the forest situation. The resurvey reveals the changes that have occurred and the trends that have developed since the first survey.

The Missouri forest inventory is part of the nationwide effort to maintain a current account of our forest assets as authorized by Congress in the McSweeney-McNary Forest Research Act of 1928. The State of Missouri, aware of the importance of its forest resources, appropriated $80,000 in the 70th session of the Missouri General Assembly to assist in the inventory of these resources. This appropriation supplemented Federal funds available and made a more intensive survey possible. Thus it was possible to present data by counties for the more heavily forested regions of the State.

The resurvey was conducted by the Lake States Forest Experiment Station in cooperation with the School of Forestry, University of Missouri, which administered the State functions of the survey. The Central States Forest Experiment Station participated in the studies of timber cut, assisted in compiling the data, and prepared this report.

The North Central Region of the U.S. Forest Service surveyed the National Forests in Missouri, and the Missouri Conservation Commission and the T. J. Moss Tie Company provided men and equipment to assist in surveying areas of their interest. We gratefully acknowledge these contributions.

We also thank the U.S. Agricultural Stabilization and Conservation Service in Missouri and the Mark Twain and Clark National Forests for providing field survey crews with office space and aerial photographs.

The resurvey was directed by Clarence D. Chase, leader of the Forest Survey Project at the Lake States Forest Experiment Station. Arthur G. Horn was responsible for compiling timber cut and product information. Timber supply data were compiled by Burton L. Essex.

The value of Missouri's forests is associated with several important and interrelated resources including water, fish and wildlife, range, and recreation as well as timber, but a discussion of all of these is beyond the scope of this report. The purpose of this publication is to present a comprehensive picture of the timber resource.

Central States Forest Experiment Station, U.S. Dept. of Agriculture
Forest Service, 111 Old Federal Building, Columbus, Ohio
R. D. Lane, Director

MISSOURI'S FORESTS

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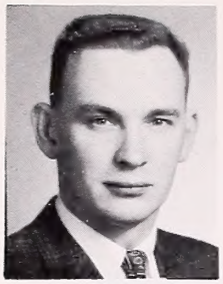

THE AUTHOR

DAVID A. GANSNER began his Forest Service career in 1958 at the Lake States Forest Experiment Station, working on the Forest Survey in Missouri and Minnesota. In 1961 he moved to the Central States Station and his present job as Forest Survey Representative. A native of Missouri, Dave received his degree in forestry from the University of Missouri. He is a member of the Society of American Foresters and Xi Sigma Pi (honorary forestry society).

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Highlights

The second comprehensive inventory of Missouri's forest resources was completed in December 1960. Statistics gathered in this inventory show that the timber has improved since the first survey in 1947. Changes in public attitude toward timber growing and better methods of fire protection have led to these improvements.

Missouri's forests were once thought to be endless, and were used indiscriminately and without regard to the future. So poorly stocked stands full of fire-scarred culls developed. The forests are now in the process of rebuilding. The number of young and vigorous trees has increased and growth rates are higher. Thus, even though the acreage of commercial timberland in the State has remained about the same, stocking and volume of sound timber have increased. On the average, Missouri's forests contain about 70 cubic feet more total growing stock and 20 board feet more sawtimber volume per acre today than in 1947. Because many trees that were poletimber size in 1947 have grown into small sawtimber, the acreage of sawtimber-size stands has doubled.

Efforts to restore pine have paid dividends. Pine is now the major component on 330,000 acres of commercial forest in Missouri. Growing-stock volume increased by 66 percent and sawtimber volume increased 45 percent in the 12 years between inventories.

Sawtimber is generally smaller and hence of lower quality than in 1947. But, today's sawtimber is younger and has higher quality-growth potential, and the supply of this young sawtimber is increasing at a rapid rate.

On the whole, then, the timber resource picture in Missouri appears brighter.

Missouri's forests still need help from man. In general, the State's woodlands are still in poor condition and are producing far below their potential. Only 12 percent of the 15 million acres of productive forest land is well stocked with merchantable or potentially merchantable trees. For every seven growing-stock trees of merchantable size there are three culls and many of the trees that do qualify as growing stock are of low quality. In the heart of the Ozarks, forests contain an average of only 600 board feet per acre and growth rate averages less than 50 board feet per acre per year. Obviously before productivity can be increased greatly, stocking must be increased.

While overall the actual cut of timber is less than the desirable cut (the cut that can be made while maintaining a steady flow of wood products and improving the balance of tree sizes), a few important timber species are being over cut, especially the large trees where high-quality wood is concentrated. As a result, the supply of sawtimber in trees more than 15 inches in diameter (the minimum size preferred by producers of high-quality lumber, veneer, cooperage, handle stock, etc.) has been dwindling at a rate of 56 million board feet per year over the past 12 years. If this decline continues it could soon have severe effects on traditional forest-based industries that depend on a steady supply of high-quality timber.

The future of timber supplies in Missouri is in the hands of about 200,000 small-private-woodland owners who own most of the forest resource. As a group they are not practicing sound forest management. During the next 30 years the demand for timber products is expected to rise steadily with increases in population and national income. Unless small-woodland owners put forestry to work, there is no guarantee that supplies of high-quality timber will be sufficient to meet increasing demands.

Timber Trends

FOREST AREA

15 Million Acres of Forest

About 15.3 million acres, 35 percent of Missouri's land area, are forested and all but about 300,000 acres are commercial forest land. Two-thirds of the forest is in the hilly, oak- and hickory-covered Ozark Region in the southern part of the State. The rest occurs in the prairie farming region of northern and southwestern Missouri, on the hills and bottoms adjacent to the Missouri and Mississippi Rivers, and on the alluvial flatland in the extreme southeastern corner of the State (fig. 1).

The 14-county Eastern Ozark Region is the heart of Missouri's forest resource. Though occupying only 14 percent of the total land area, the region accounts for 29 percent of the State's forest land and 37 percent of the growing-stock volume. More than one-fourth of all the timber cut annually in Missouri is taken from the Eastern Ozarks.

Most of Missouri's 300,000 acres of noncommercial forest is unproductive land, such as dry, rocky ridges that are too poor for timber production. But noncommercial forest also includes productive areas such as state parks and wildlife refuges where timber cutting is prohibited. Though not producing commercial timber, this noncommercial forest contributes to the State's watershed, wildlife, and recreation resources.

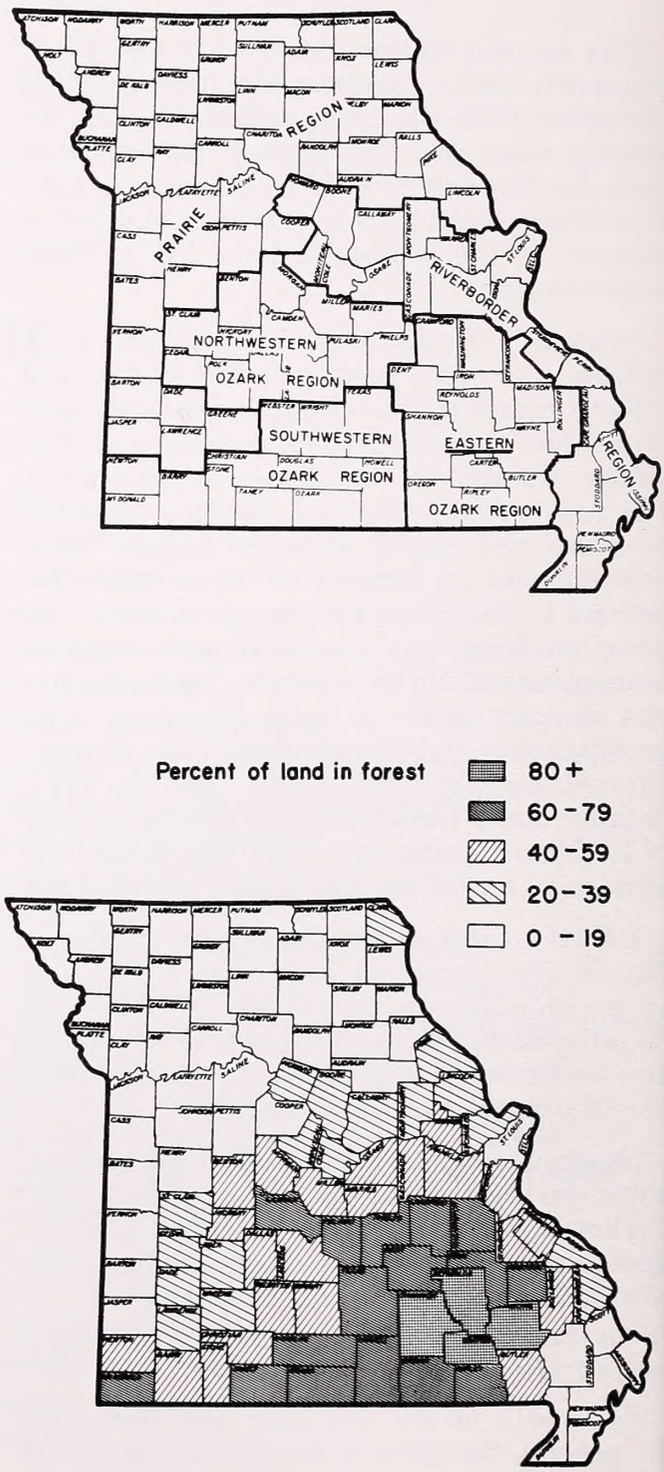


FIGURE 1. — Location of forest survey regions in Missouri, and percent of land forested by counties.

Little Change in the Acreage of Productive Timberland

Increases and decreases in forest over the past 12 years have nearly balanced one another (fig. 2). Today there are 14,977,000 acres of commercial forest in Missouri — a decrease of only 97,000 acres (less than 1 percent) since 1947.

Some of Missouri's commercial forest has given way to nonforest uses since the time of the first forest inventory. Forest land has been cleared to make room for farms, factories, and cities. New state parks, roadside parks, and water impoundments now occupy areas that were producing timber crops in 1947. On the other hand, a large amount of land that was nonforest in 1947 has shifted to commercial forest. Between 1950 and 1959 the quantity of Missouri land in farms decreased by about 2 million acres. In addition, more than 800,000 acres of farmland were put into the Soil Bank (Conservation Reserve contracts) between 1956 and 1960. A portion of this idle farmland — much was pasture already containing a few scattered trees — has reverted to forest.

The biggest changes in commercial forest acreage took place in Missouri's Prairie and Riverborder Regions. Idle cropland and pastureland in the Prairie reverted to forest accounting for most of a 14-percent increase in commercial forest area in this region. Extensive land clearing for agriculture took place on the rich alluvial bottomland in the six-county "boot heel" area of the State. Here commercial forest area decreased about 40 percent.

FIGURE 2. — The forest picture in Missouri is constantly changing: some cropland and pastureland is reverting to woodland . . .

and some forest is being cleared for farming.

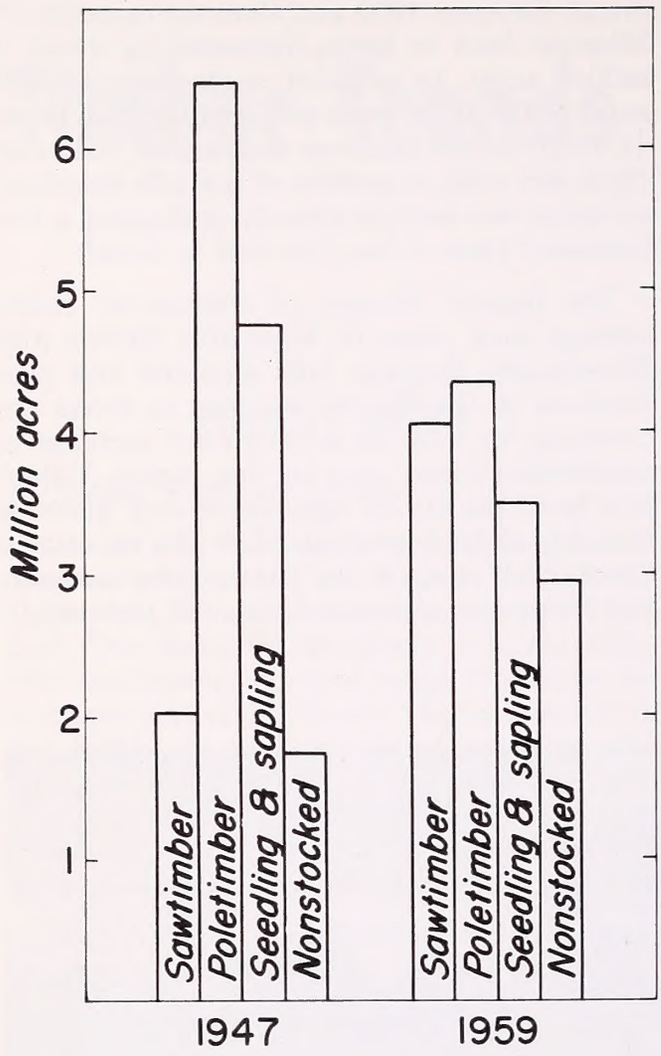


FIGURE 3. — Change in area of commercial forest land by stand-size class.

Stands Improving But Still in Poor Condition

In the past Missouri's forests were subjected to devastating fires and misuse that left them in poor condition. Sustained efforts by local forestry agencies to prevent wild fires, encourage proper management of woodlands, and improve cutting practices have begun to correct this situation. With improved fire protection, the number of sound, young, growing-stock trees in Missouri's woodlands has increased. There are now almost twice as many sound saplings (trees 1 to 5 inches in diameter at breast height) and about 1.3 times as many sound poletimber trees (trees 5 inches d.b.h. to sawtimber size) per acre as there were in 1947. Many pole-size trees have grown into small sawtimber and as a result the acreage of sawtimber stands has doubled. Sawtimber stands now account for 27 percent of the commercial forest acreage. Though decreasing by one-third, poletimber stands remain the predominant size class (fig. 3).

A close look at stocking indicates that the job of bringing Missouri's forests back to their potential has progressed but is far from complete. The average commercial forest acre in 1947 contained 242 cubic feet of merchantable growing stock. Today this acre contains 309 cubic feet.[1] Despite this volume increase only 12 percent of Missouri's commercial forest is well stocked (figs. 4 and 5). Fifty-seven percent of the forest area is poorly stocked or nonstocked — not so much for lack of trees, but for lack of *good* trees. For example, there are three culls for every seven growing-stock trees over 5 inches. And, there are three sawtimber-size culls for every four sound sawtimber-size trees. In addition, hardy shrub-like trees, such as dogwood, redbud, and ironwood, have taken over much of the forest's growing space and occupy areas that could be supporting potential crop trees.

[1] Tables used to compute volumes for 1959 differ from those used to compute volumes for 1947. Adjustments were made in 1947 volume to permit comparisons with 1959 data.

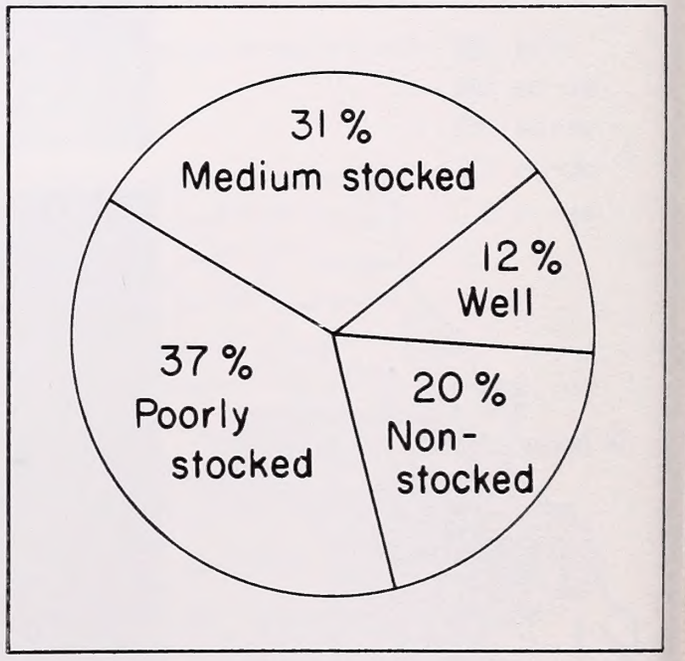


FIGURE 4. — Distribution of commercial forest area by stocking class, 1959.

Pine Stands Are Increasing

Stands in which shortleaf pine is a major component occupy about 330,000 acres. This is only a small proportion of the estimated 4 million acres of pine that originally occupied the State. But public and private forest managers are bringing the pine forests back to Missouri (fig. 6). They have planted pine on understocked and open areas. They have removed unwanted competing hardwoods and thinned overstocked pine stands. Through protection and education they have reduced fire losses and overgrazing and helped to establish better cutting practices. Their work has resulted in a 46-percent increase in the area of pine stands since 1947.

The acreage of pine sawtimber stands has tripled. Today more than one-third of the pine area supports sawtimber stands compared with less than one-fifth at the time of the first survey.

FIGURE 5. — A well-stocked oak stand.

FIGURE 6. — Concentrated efforts by forest managers are reviving Missouri's pine resource.

Most of the effort to bring pine back was concentrated on the National Forests in the Eastern Ozark Region of the State. Now almost three-fourths of Missouri's pine stands occur in the Eastern Ozarks. In this region pine acreage has doubled and pine volume has increased by 30 cubic feet per acre since 1947.

Oak-Pine Stands Have Decreased

Oak-pine, a type in which hardwoods are a major component and shortleaf pine a lesser component, accounts for 4.3 percent of Missouri's commercial forest. Three-fourths of the oak-pine acreage occurs in the Eastern Ozarks. Since the first inventory this type has decreased in the State as a whole by 20 percent and in the Eastern Ozarks by 23 percent. Stand conversion has accounted for a large portion of this reduction. Since oak-pine stands are already partly stocked with pine and usually contain a pine seed source, they have been prime targets for conversion to pine. Conversion efforts have been concentrated on stands of small timber where large hardwoods are not well established. This in large part explains why oak-pine sawtimber acreage has doubled while the acreages of pole-size, restocking, and nonstocked oak-pine have fallen off sharply.

Oak-Hickory the Predominant Forest Type

Hardwood stands fall into one of four major hardwood forest cover types recognized throughout the Eastern United States: oak-hickory, oak-gum-cypress, elm-ash-cottonwood, and maple-beech. Because the definitions of cover types changed between inventories, a close look at acreage trends in individual hardwood types is not feasible. However, acreage of all hardwood stands combined decreased less than 1 percent. A sharp increase in hardwood stand acreage occurred in the Prairie Region where idle farmland has reverted to forest. Most of this new forest land has come into the elm-ash-cottonwood type. Land clearing removed large portions of the elm-ash-cottonwood and oak-gum-cypress forest from the alluvial flatlands in southeastern Missouri.

Oak-hickory is still the most extensive forest cover type. It accounts for 76 percent of the commercial forest area and is well represented in every region of the State. Only in the Prairie Region of Missouri does this type cover less than three-fourths of the commercial forest area. Oak-hickory most typically occurs as a mixture of white oaks, red oaks, and hickory. Pure stands of white oak occur on lower slopes and in sheltered coves where site quality is high. On poorer sites — dry ridgetops and glade areas — oak-hickory occurs as a mixture of post oak and blackjack oak or as a mixture of redcedar and hardwoods.

Elm-ash-cottonwood, Missouri's second most extensive type, accounts for 15 percent of the commercial forest land in the State. This type normally occurs as a mixture of soft-textured hardwoods, such as elm, soft maple, green ash, blackgum, cottonwood, and sycamore, and is found primarily in stream bottoms and secondary drainages. Elm-ash-cottonwood is the major forest type of the Prairie Region where bottomland areas too wet for agriculture have been left in timber. More than three-fifths of the elm-ash-cottonwood forest is located in the Prairie.

The oak-gum-cypress type, called lowland oak in regions where cypress does not occur, comprises less than 3 percent of the State's commercial forest area. This type is generally found on alluvial soil on poorly drained flatland. The major species are gum, oak (primarily pin and swamp white), and cypress. This is typical in the southeastern "boot heel" counties where it accounts for half of the forest area.

Only 85,000 acres of forest are classified as maple-beech, the least extensive type in Missouri. Maple-beech stands contain hard maple in combination with other hardwoods such as elm, ash, basswood, and red oak. Beech is found only in a limited area near Crowley's Ridge in the extreme southeastern portion of the State.

90 Percent of the Forest in Private Ownership

There has been little change in the pattern of forest land ownership in Missouri since 1947. About 90 percent of the timber-producing land is still privately owned. Farmers alone own more than 60 percent of the commercial forest.

The U.S. Forest Service, the major owner of public land, has added 114,000 acres of productive timberland to its holdings since 1947. In 1959, the National Forests contained about 9 percent of Missouri's commercial forest land.

The remaining commercial forest acreage, less than 2 percent, is divided among other Federal, State, county, and municipal ownerships.

TIMBER VOLUME

Total Growing Stock Up One-Fourth

Today there are more than 4.6 billion cubic feet of growing stock (volume in sound trees 5 inches and larger) in the State. This represents a 26-percent increase in volume — more than 2 percent per year — from 1947 to 1959. Most of this increment is the result of a large increase in small timber. Merchantable wood in trees of poletimber size has increased by more than half. At the time of the last inventory, 45 percent of the State's growing-stock volume was in poletimber-size trees while now 54 percent of the volume is in this size class (fig. 7).

The increase in volume was not distributed proportionately across the State. The most noteworthy change occurred in the Eastern Ozarks where growing stock increased 63 percent — more than 5 percent per year.

The volume of hard-hardwood species (oak, hickory, black walnut, ash, etc.) has increased by one-third. Large volume gains were recorded for nearly all the major hard-hardwood timber species. White oak volume is up 31 percent, all red oaks 42 percent, and walnut 22 percent. Hard hardwoods now account for 84 percent of the growing stock. This is good news for local-wood-using industries since four-fifths of the wood they use is hard hardwood.

The volume of soft hardwoods (elm, soft maple, gum, cottonwood, etc.) has dropped 5 percent.

A 66-percent increase in shortleaf pine volume offset sharp decreases in cypress and redcedar; and as a result, softwood growing stock as a whole is up 13 percent from 1947. Softwood volume has more than doubled in the Eastern Ozarks where most of the pine forest is located.

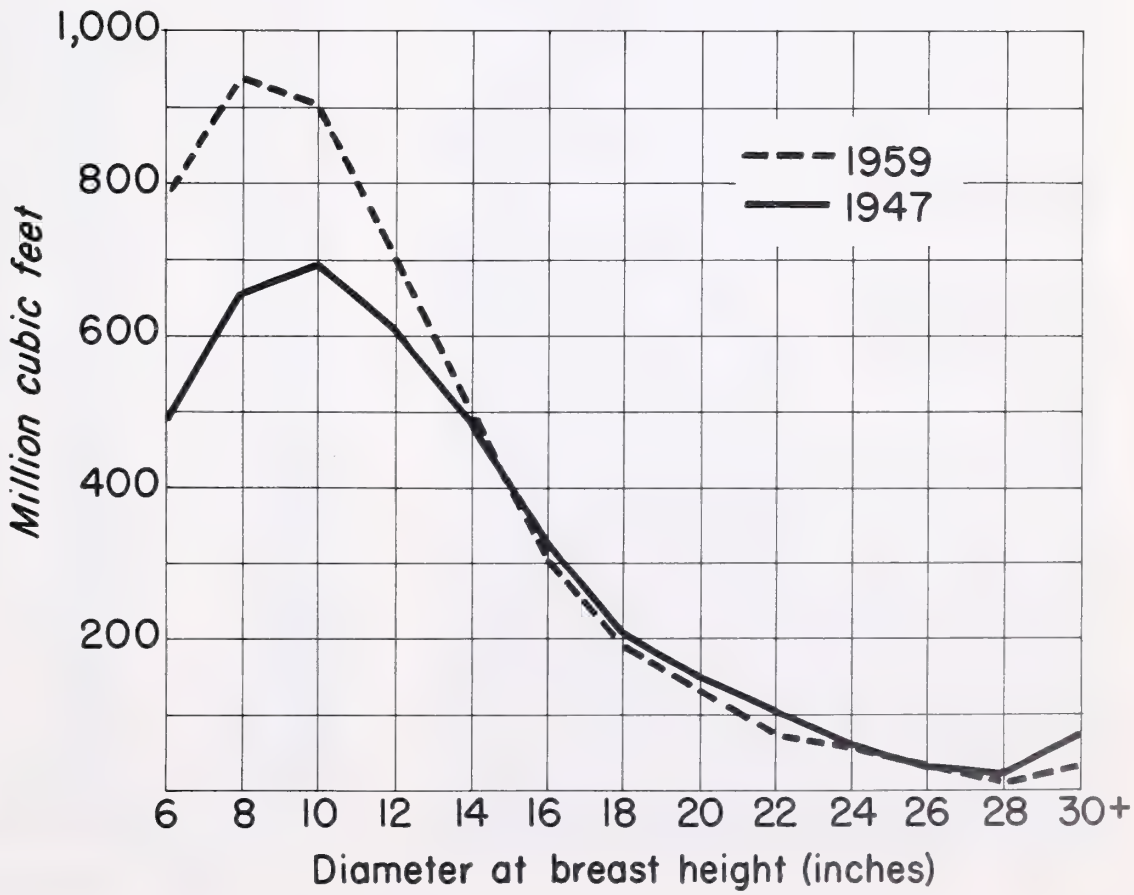


FIGURE 7. — Total growing-stock volume by d.b.h. class, 1947 and 1959.

Only a Slight Increase in Sawtimber Volume

Missouri's larger timber has not fared as well as the younger growing stock. Since 1947, the volume of saw log material has increased less than 2 percent. There was a large increase in small sawtimber: volume in trees 9 to 12.9 inches d.b.h. increased 22 percent. But this gain was offset by an 18-percent drop in volume in trees 17 inches d.b.h. and larger (fig. 8).

The revival of Missouri's pine resource is evidenced by a 45-percent increase in shortleaf pine sawtimber volume between surveys. In the Eastern Ozark Region pine sawtimber volume has increased from 66 to 127 board feet per acre. National Forest land in the Eastern Ozarks now contains an average of 390 board feet of pine per acre.

Other softwood sawtimber volume has decreased sharply in the State. A marked reduction in cypress was due mainly to land clearing in the southeast where most of Missouri's cypress timber is concentrated.

Oaks contain 65 percent of the State's sawtimber volume and account for three-fourths of the sawtimber harvest. Oak sawtimber volume has increased 4 percent over the last 12 years. The bulk of this increment was in trees too small to make high-quality-timber products. Sawtimber volume of white oak *(Quercus alba* L.), the most abundant individual species in the State, is up 5 percent. All red oak sawtimber has increased 7 percent.

The increase in sawtimber volume would have been greater but for the prolonged drought of the middle 1950's. The drought took its toll on all the State's timber species but the effects were most severe on the red oaks. Black oak, the second most abundant individual species in the State, was dying at a

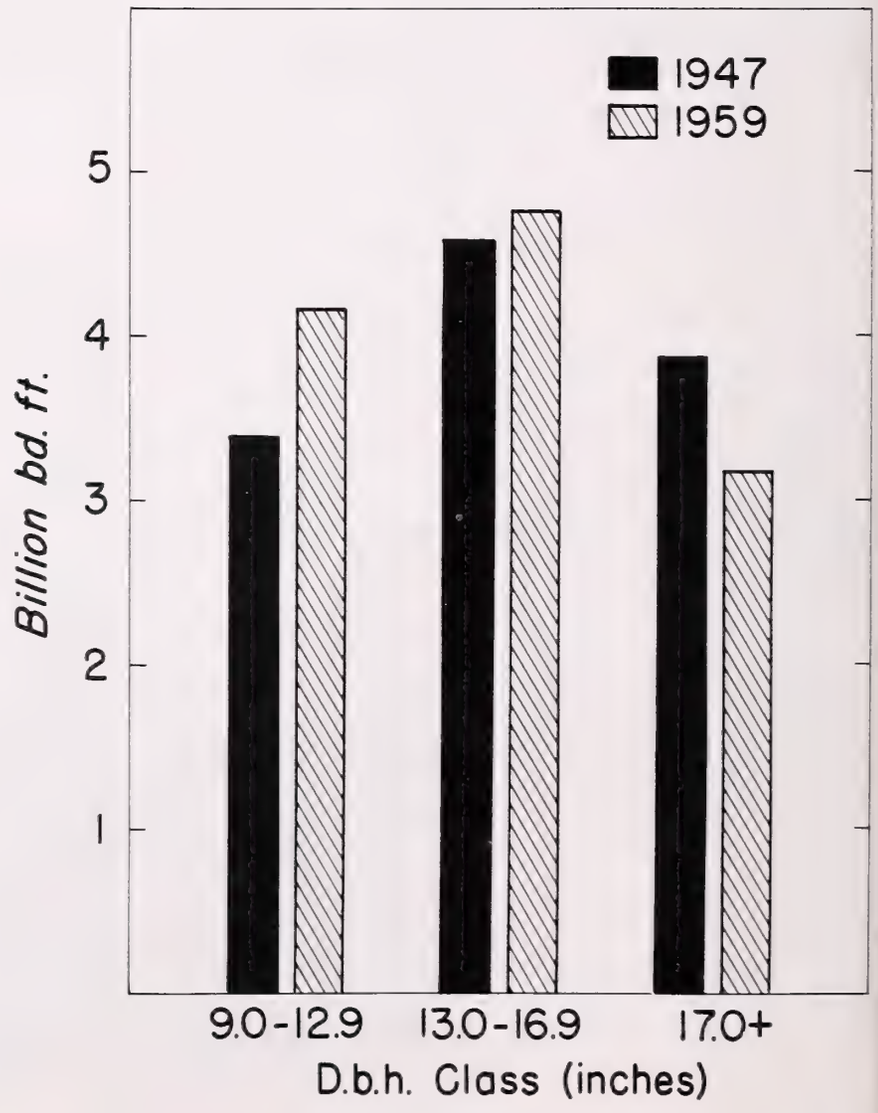


FIGURE 8.—Sawtimber volume by tree-size class, 1947 and 1959.

rate of 84 million board feet per year in 1959. This mortality amounted to 4 percent of the black oak sawtimber supply and was 1.4 times the average amount of black oak sawtimber cut annually for wood products.

Missouri's black walnut sawtimber volume has increased 18 percent and is still rising. Walnut sawtimber is growing five times faster than it is being cut. This comparison is deceptive, however, because the cut is concentrated on the large trees of high quality while most of the growth is occurring on younger, smaller trees.

Hickory still is a problem species throughout the hardwood region of the United States. The supply of hickory is increasing while markets are limited. In Missouri hickory is being cut at a rate of only 13 million board feet per year — 32 million board feet short of the recommended cut. Hickory sawtimber volume has increased 18 percent and now accounts for almost 7 percent of the sawtimber volume in the State. Unless new markets are found, the hickory problem will continue to mount.

Soft-hardwood sawtimber volume has decreased 17 percent since 1947. Volume losses have been large in all regions of the State except the Prairie, where the volume is up 10 percent. Cottonwood sawtimber volume has been reduced drastically in the last 12 years because of extensive land clearing for agriculture in the riverbottoms of southeastern Missouri and general overcutting throughout the State. The current annual cut of cottonwood sawtimber is eight times the growth rate. The elm sawtimber supply has been increasing rapidly despite heavy losses to Dutch elm disease and phloem necrosis. Elms are fast-growing, aggressive trees that quickly occupy idle land and, like hickory, have limited markets. A 30-percent increase in elm sawtimber took place in the Prairie Region between surveys. Elm now accounts for more than half of all the soft-hardwood sawtimber in the State.

FIGURE 9. — Giant white oaks such as these, once commonplace in Missouri, are becoming a rarity.

Sawtimber Has Lower Quality But Higher Potential

The increase in small sawtimber and the accompanying decrease in large sawtimber has lowered the average size of sawtimber trees in Missouri. Since timber quality is directly related to size, the volume of high-quality saw logs has declined. This trend has occurred throughout the eastern hardwood region of the United States.

In 1947, there were 5.8 billion board feet of merchantable sawtimber in trees over 15 inches d.b.h. (the minimum size preferred by producers of high-quality lumber, veneer, cooperage, handle stock, etc.). Since then, the volume in trees of this size has dwindled to 5.1 billion board feet — an average decrease of 56 million board feet per year (fig. 9).

A sample of the merchantable sawtimber-size trees was graded to obtain an up-to-date measure of saw log quality. Hardwood sawtimber was classified according to four log grades (I, II, III, and Tie-and-Timber) and softwood volume according to three grades (I, II, and III). Results were not surprising. They indicate that 84 percent of all Missouri's sawtimber is of either Grade III or Tie-and-Timber quality (fig. 10). Less than 15 percent of the hardwood inventory is Grade II or better and only 1.5 percent qualifies as Grade I. More than half of the hardwood sawtimber is Tie-and-Timber Grade. The quality of softwood sawtimber is higher, with almost 40 percent in Grade II or better and 13 percent in Grade I.

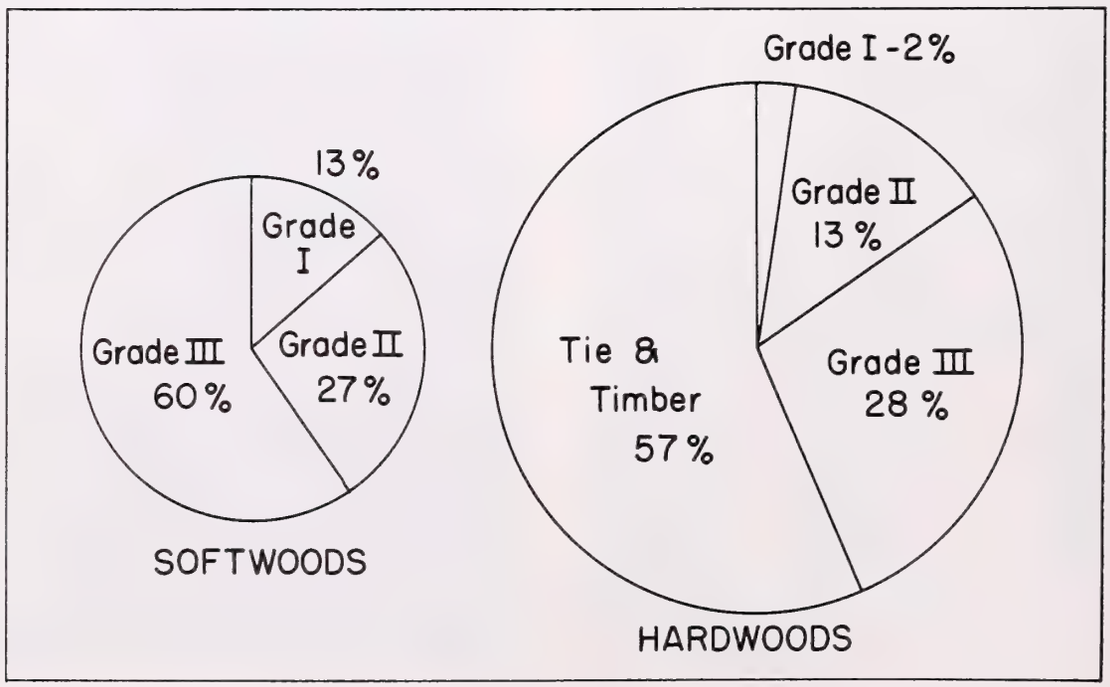
While log grading does provide a measure of present-day quality, it is an inadequate basis for gauging timber-quality potential. Size is an important factor in log grading and so many young and vigorous sawtimber trees that have little or no defect, do not contain high-grade logs simply because they are too small. Almost 60 percent of the State's sawtimber is in trees less than 15 inches d.b.h. Thus the future is not as bleak as it may seem. In fact, Missouri's forests can, with continued scientific forest management, produce enough high-quality sawtimber to satisfy both current and future demands. Not only is the supply of young sawtimber more abundant, but what there is has higher quality-growth potential than in 1947. Now that fire damage has been greatly reduced, the proportion of unscarred, healthy, young sawtimber trees is increasing rapidly. Sound sawtimber is being cut at a rate of 364 million board feet per year but is growing at a rate of 758 million feet per year. This leaves a net increase of 394 million board feet (3¼ percent per year).

Farmers Own Most of the Timber

Privately owned woodlands contain 84 percent of the growing stock and 88 percent of the sawtimber volume in the State. Farmers own about three-fifths of the timber volume. Another one-fourth is in the hands of forest industries and other private owners. The remaining volume is on land owned by Federal, State, and local public agencies. Almost nine-tenths of the timber volume in public ownership is on National Forests administered by the U.S. Forest Service and most of the remaining public timber is in State Forests operated by the Missouri Conservation Commission.

Sawtimber volume in public forests increased an average of 100 board feet per acre between inventories while the volume on private land increased only 9 board feet per acre. It is apparent there has been better forest management on public land.

FIGURE 10. — Distribution of sawtimber volume by log grades, 1959.



TIMBER GROWTH AND CUT

Timber is Growing Faster

Because of the increase in young and vigorous timber between surveys, current annual growth on all growing stock is much greater than in 1947. Missouri's merchantable timber is growing at the rapid rate of 242 million cubic feet or more than 5 percent per year. Softwood volume is growing at an annual rate of 6.3 percent and hardwood at 5.2 percent.

Sawtimber volume is growing at an even faster rate than total growing stock. Current sawtimber growth is 758 million board feet or 6.3 percent annually. Sawtimber volume growth is 13 percent greater than in 1947. The main reason for increased sawtimber growth is that a greater proportion of today's sawtimber volume is in small, healthy, and fast-growing trees. In fact, 70 percent of the current annual sawtimber growth is ingrowth, i.e., the volume of trees that are just reaching sawtimber size.

Pine sawtimber is growing 71 million board feet per year. This is more than twice the net growth of pine sawtimber at the time of the first survey. The growth of white oak, elm, and walnut sawtimber is also greater than in 1947, while that of cypress, redcedar, cottonwood, and red oak sawtimber is less.

The Eastern Ozark Region accounts for about 40 percent of all the current timber growth in Missouri. In the Eastern Ozarks, sawtimber is growing at a rate of 9.7 percent and all growing stock at a rate of 5.8 percent per year.

As mentioned previously timber growth, and particularly sawtimber growth, would have been greater still but for the drought of the 1950's which killed many trees (fig. 11). Losses were especially high in larger trees that had already been damaged by fire, disease, and insects. In trees that weren't killed, growth was reduced. The mortality rate for sawtimber in the State was more than three times as high in 1959 as it was in 1947. Only ingrowth kept total sawtimber growth ahead of mortality in the hot, dry, ridge country of the Southwestern Ozarks. In this region, large sawtimber was dying faster than it was growing. In at least one respect the drought was a blessing: it killed many defective, old trees and made room for young ones. As the effects of the long, dry spell diminish, growth rates should rise, particularly for the red oaks and in the dry regions of the State.

FIGURE 11. — The prolonged drought of the 1950's killed many trees — red oak was the hardest hit.

Missouri's timber is growing at a rate of 16 cubic feet of growing stock and 51 board feet of sawtimber per acre per year. These rates represent increases over those of 1947 but they are still far below the productive capacity of the State's woodlands.

A Sharp Reduction in Timber Cut

In 1958, a total of 78 million cubic feet of merchantable growing stock was cut. This is only about half the volume that was harvested from the State's forests in 1946. A decline in lumber production accounts for most of this difference in timber cut. During World War II, and the years immediately following, the demand for lumber was high but it fell abruptly in the 1950's. In 1946, 82 million cubic feet of growing stock was cut for lumber, compared with 38 million cubic feet in 1958.

There has also been a marked decline in the use of wood for cooperage and fuel. The amount of merchantable wood cut for these two products decreased 27 million cubic feet between 1946 and 1958.

Lumber-logging operations still account for most of the annual drain on growing stock. Sixty-three percent of the sawtimber and 48 percent of the growing stock cut in 1958 were for lumber. Fuelwood ranks second to lumber accounting for 13 percent of the sawtimber cut and 25 percent of total drain.

Four-fifths of the current annual cut of growing-stock timber is from sawtimber-size trees. The proportion of the cut from pole-timber trees is lower than in 1946, mainly because of reductions in the use of fuelwood, wooden mine props, and fenceposts.

As in 1946, well over 90 percent of the timber cut is hardwood. Oaks account for three-fourths of the timber cut, and about two-thirds of the oak cut is from white oaks. In 1946 the largest volume of cut came from red oaks. The cut of both red and white oaks has dwindled but the reduction in the red oak cut has been more severe, partly because of the decline of the hardwood flooring industry since nonwood flooring materials such as asphalt and vinyl have become popular. After the oaks, short-leaf pine, hickory, cottonwood, elm, and walnut rank in that order in terms of volume cut.

Only about 6 percent of the annual cut of growing stock comes from public holdings even though these holdings occupy almost 11 percent of the State's commercial forest area, and are more heavily stocked than private holdings. This in part reflects public policy to restrict cutting until adequate stocking is achieved.

The Gap Between Growth and Drain Has Widened

Since the time of the first inventory growth rates have increased while cutting rates have declined. Currently, growing stock is growing at an average annual rate of 5.2 percent; the annual cutting rate is only 1.7 percent. Sawtimber is growing at a 6.3-percent rate and being cut at a rate of 3 percent. These data indicate that growing-stock and sawtimber volumes are each increasing at an average rate of about 3.5 percent per year. At the time of the first timber inventory, both growing stock and sawtimber volumes were increasing at an estimated average rate of less than 2 percent per year.

Annual Cut is Short of Desirable Levels

During the next decade approximately 160 million cubic feet of growing stock can be harvested annually from Missouri's woodlands while still maintaining a well-balanced distribution of age classes and progressively building toward a desirable density of good growing stock. This recommended annual rate of cutting is twice the actual rate (fig. 12).

As one might expect, the ratio of desirable cut to actual cut is not the same for all regions of the State nor is it the same for all species and all sizes. In the Southwestern Ozarks, for example, the cut of sawtimber already exceeds desirable levels while in the Prairie Region the sawtimber cut could be doubled and still not exceed the recommended cut.

A few of Missouri's important timber species are cut too heavily and virtually all of the overcutting occurs in the larger sizes. The pine, walnut, and cottonwood sawtimber harvests exceed desirable levels — the cottonwood harvest is twice as large as recommended. But most of Missouri's timber species are not cut heavily enough, the gap between actual and desirable cutting being greatest for small timber and for species such as hickory and elm for which markets are limited. The harvest of poletimber-size trees could be quadrupled, and more than five times as much hickory and elm could be harvested. But before this can be done, new markets for small growing stock and little-used species must be developed.

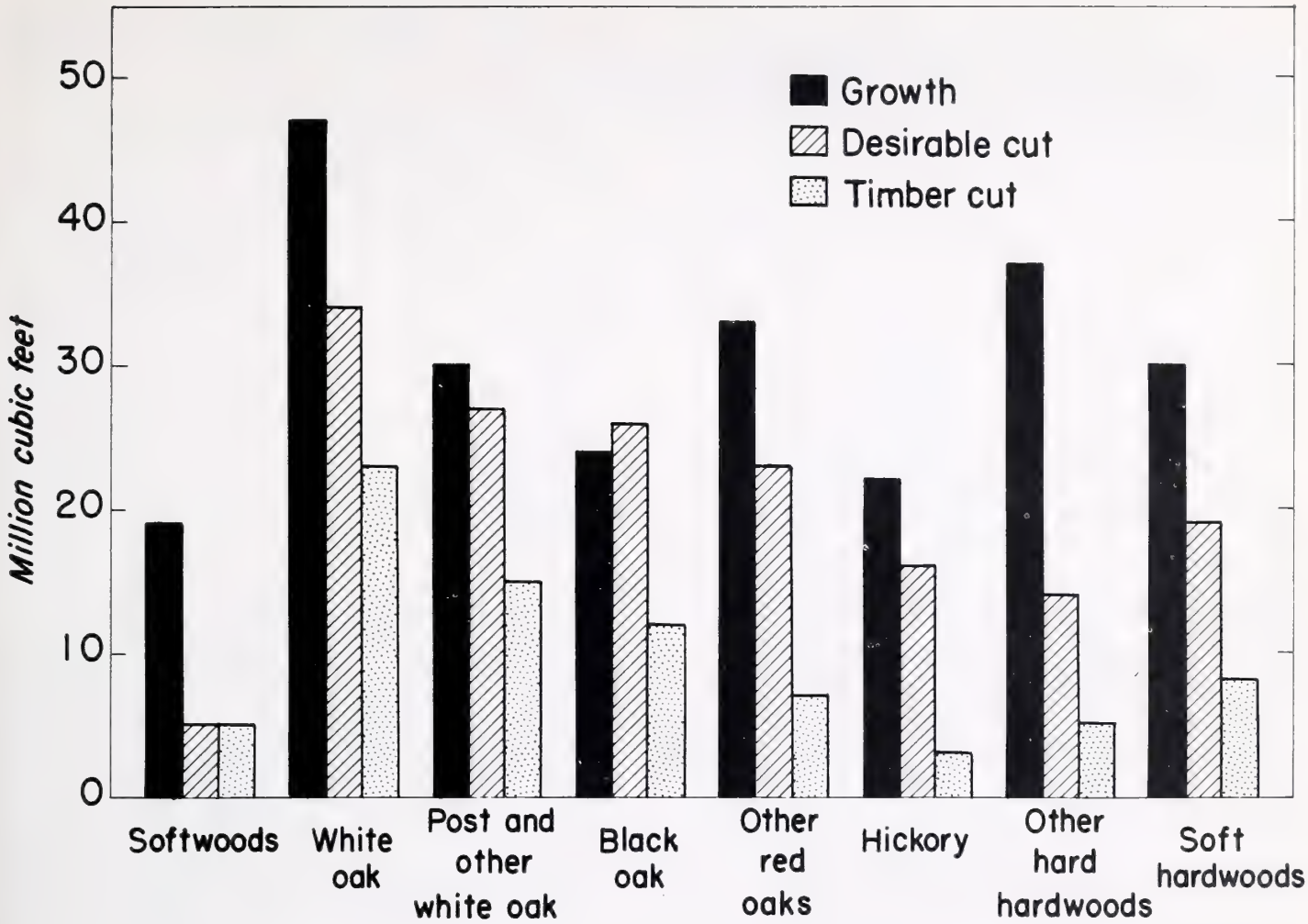


FIGURE 12. — Annual net growth, desirable cut, and timber cut from growing stock by major groups of species, 1959.

Timber Industries

Timber industries play an important role in Missouri's economy. In 1958, more than 69,000 people were employed in timber-based economic activities including the management of forest land; the harvest, manufacture, transportation, and marketing of wood products; and the construction of wooden buildings. In the same year timber products worth more than $22 million were harvested from the State. The value of products shipped from primary-wood-using industries (processors of rough logs and bolts) and secondary industries (those that remanufacture primary products) exceeded $395 million. Much of this timber-based activity is concentrated in rural counties where industrial enterprises are scarce. In many areas of Missouri's Ozark Region sawmills, charcoal plants, stave mills, and so forth, are the main sources of employment for local residents.

Currently, there are about 1,150 active, primary-wood-using establishments in the State. Included in this number are some 1,000 sawmills, 60 charcoal plants, 36 stave mills, 12 handle plants, 3 veneer mills, and 2 woodpulp mills. There has been a decrease of 1,600 sawmills, 49 stave mills, 7 handle plants, and 3 veneer mills since 1946. The number of charcoal plants has increased by 57. There were no known woodpulp mills in the State in 1946 (fig. 13).

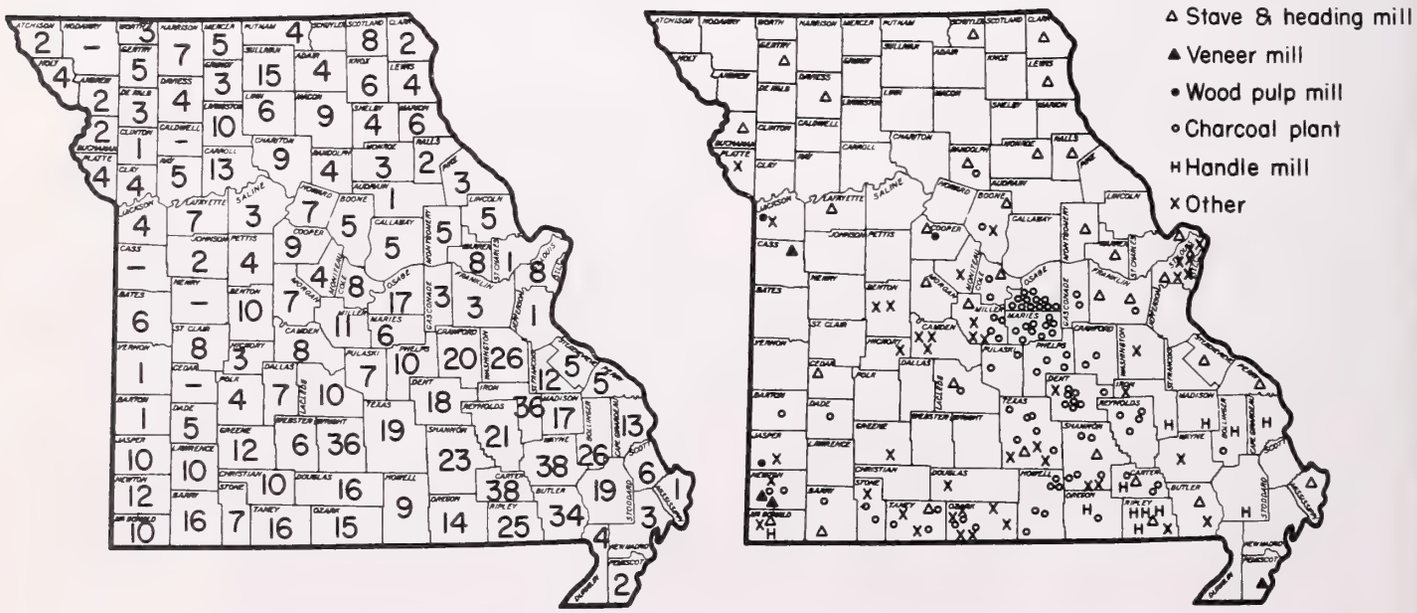


FIGURE 13. — Number and location by county of Missouri's primary-wood-using industries: Left — Sawmills (Source: McCormick, L. E., and Smith, Richard C. Directory of Sawmills and other wood-using plants in Missouri. Mo. Agr. Col. Ext. Cir. 733, 56 pp. 1961). Right — All others.

Here is a comparison of quantities of Missouri wood output by products — 1946 and 1958:

Product	*Volume of wood used*		
	1946 (Million cubic feet)	*1958* (Million cubic feet)	*Change* (Percent)
Lumber logs	79.4	47.8	—40
Fuelwood	83.1	74.0	—11
Posts	11.0	9.6	—13
Cooperage logs	14.9	4.5	—70
Mine timber	3.4	.5	—85
Veener logs	1.4	1.0	—28
Handle logs	1.3	1.2	—10
Pulpwood	.5	.9	+89
Other (charcoal wood, poles and piling, and other miscellaneous industrial wood)	2.9	9.2	+217
All products	197.9	148.7	—25

About 149 million cubic feet of Missouri wood was used for timber products in 1958 — 25 percent less than in 1946 when post-war demands for wood products were high. The volume of wood now used for lumber and cooperage logs combined is 45 percent less than in 1946.

More Missouri wood is used for fuel than for any other product. Still, lumber logs must be considered the most important forest product because they have higher value and they account for the largest drain on the growing stock. About 74 percent of the wood used for fuel comes from nongrowing-stock sources such as limbwood, dead and cull trees, and plant by-products, while 72 percent of the lumber-log output comes from growing-stock timber.

LUMBER PRODUCTION DOWN

At the turn of the 20th century lumber production reached its peak, nearly 725 million board feet. Extreme lows were recorded during the depression years. In 1932, for example, only 140 million board feet were produced. As the depression subsided, sawmilling increased and production began to rise again. By the late 1930's it was up to 300 million board feet. Production continued to increase to meet heavy demands during World War II and the years immediately following. A modern-day high of just under 520 million board feet was reached in 1946. Since then production has come down again. In 1958, the State's sawmills produced 314 million board feet of lumber.

In the early days, softwood timber was plentiful and pine, cypress, and redcedar made up a large percentage of the lumber produced. With continued overcutting, the supply of softwood timber gradually dwindled. Today, more than 90 percent of the lumber produced in the State is hardwood.

Average production per sawmill is higher today than it was at the time of the first survey. In 1946, nearly 2,600 sawmills were producing an average of 200,000 board feet each. Currently, production averages about 320,000 board feet per mill. The number of active mills today is only three-eighths of the number that were operating in 1946, but the number of larger mills (those producing more than a million board feet annually) is about the same.

A LEADING PRODUCER OF COOPERAGE LOGS

Missouri accounts for about 15 percent of the annual harvest of cooperage logs in the United States (fig. 14). In 1946, the Nation's distilling industry was flourishing and the demand for tight cooperage was strong. Slack barrels were also used more extensively. During 1946 almost 100 million board feet of cooperage logs were cut from Missouri's woodlands and there were 85 active stave and heading mills in the State. Eighty mills were producing tight and five mills slack cooperage. Since 1946 the use of wooden barrels for shipping has been drastically reduced and distilling has returned to a more normal level. As a result, by 1958 the harvest of cooperage logs in Missouri had dropped to 31 million board feet and the number of operating stave and heading mills dwindled to 38. Only 2 of the 38 mills active in 1958 were cutting slack cooperage.

FIGURE 14. — Missouri is one of the Nation's leading producers of tight cooperage stock.

PULPWOOD AND CHARCOAL PRODUCTION UP

While the output of most of Missouri's major wood products was falling between surveys, the production of charcoal wood and pulpwood was on the rise.

In 1946, only 7,000 cords of pulpwood were produced in Missouri and all of it was shipped to pulpmills in adjacent states. Since then Missouri has acquired two woodpulp mills of its own and the mills in adjacent states have increased their use of Missouri-grown wood. As a result, production has been rising steadily. In 1958 the State's forests yielded 12,000 cords of pulpwood and by 1961 the output rose to 15,000 cords. Pulpwood is still a minor timber product in Missouri but the opportunity for expansion appears good. As yet, Missouri's pulpwood resource is virtually untapped.

The rising popularity of outdoor cooking and of charcoal-cooked foods has increased the demand for charcoal throughout the United States in recent years. Missouri's charcoal industry has responded to this increased demand. In 1946 there were three charcoal plants in the State consuming less than 9,000 cords of wood. In 1956, thirty-one charcoal plants consumed 45,000 cords. And in 1961, sixty Missouri charcoal plants consumed 154,000 cords of wood and produced 68,000 tons of charcoal.

Opportunities for Forestry

Missouri's forests have changed since 1947 and most of the changes have been for the better. The efforts to improve forest conditions must continue so that adequate supplies of quality timber will be available for present and future generations. Survey statistics point out several obvious opportunities for increasing forest productivity and improving timber utilization but funds available for forestry programs are limited. Sound choices based on scientific investigation must be made to insure that funds are put to the best possible use.

STOCKING MUST BE INCREASED

There is a great need to increase the stocking of sound desirable timber in Missouri's forests. From the air the forests over most of the State appear healthy and well stocked. On the ground, however, the perspective is somewhat different. The average forest acre in the State contains 82 live poletimber-size and 18 live sawtimber-size trees, but 22 of these poles and 8 of these sawtimber trees are culls. Almost three-fifths of the State's commercial forest is less than 40 percent stocked with present or potential growing-stock timber and much of this growing stock is in poor condition. Only about 60 percent of the standing growing-stock trees are suitable for future management. Cull and defective trees should be removed to give thrifty crop trees growing space.

In the Missouri Ozarks, the heart of the State's timber resource, forests support an average of only 600 board feet per acre, and are growing at an average rate of less than 50 board feet per acre per year. At full stocking and under a system of intensive management, some of the poorest commercial-forest sites in this region could support more than 10 times this volume at maturity. On better sites, the volume could reach 10,000-plus board feet per acre, and the growth rate might exceed 150 board feet per acre per year.

The benefits of good forest management have been well demonstrated on public forest land. For example, on National Forests in the Eastern Ozarks, sound growing-stock volume has been boosted to 590 cubic feet per acre, more than twice the average volume per acre on privately owned forest land in the State.

Of course, no boost in growing stock can be considered an achievement unless it results in an increase in the kind of timber needed by forest industries. At present, high-quality timber of desirable species is being cut faster than it is growing while the volume of species such as hickory and elm, which have limited markets, continues to increase and make up a larger percentage of the State's total timber supply.

FIRE IS STILL A PROBLEM

It was once a widespread custom in the Ozarks to burn the woods frequently (fig. 15). Nearly every stand in this section shows signs of past fire damage. Thanks to education and better systems of prevention and control, Missouri's forest fire record has shown remarkable improvement. Between 1954 and 1958 the average annual number of fires in the State was 5,400. Between 1958 and 1962 the average dropped to 3,100. The area burned

FIGURE 15. — Many fire-scarred cull trees tell a story of past misuse of Missouri's forests.

was 691,000 acres in 1949 compared with 355,000 acres in 1960. Today most of the man-made fire problems have been isolated to particular hot spots such as the Lake of the Ozarks area. Missouri's improving fire record has resulted in more healthy, young, growing stock in stands throughout the State.

Even though the fire situation has improved there is no room for complacency. Wildfire still destroys a lot of Missouri timber. Currently, fire kills an average of about 6 million cubic feet of growing stock including 20 million board feet of sawtimber each year. Mortality due to fire is equivalent to about 5 percent of the sawtimber volume cut annually from the State's woodlands and equals, or exceeds, the volume of timber cut from such major timber species as shortleaf pine, scarlet oak, northern red oak, walnut, and cottonwood. These figures show only the direct effects of fire as a killer. Even larger, but not so easily measured, are the indirect effects of fire: retarding growth, reducing quality, and reducing insect and disease resistance. Much of the decay in Missouri timber is attributed to the invasion of heart-rotting fungi through fire scars .

HEAVY LOSSES TO DISEASE AND INSECTS

Currently, diseases and insects are responsible for more than one-fourth of the timber mortality in the State. They are destroying timber at a rate of 69 million board feet per year. The effects of diseases and insects on timber growth and quality are even greater, but no accurate measures of these effects have been taken. Research into the nature and control of forest insects and diseases in Missouri has been limited and the need for expanding work in this field is apparent.

PLANTABLE AREA EXCEEDS 3 MILLION ACRES

Reforestation has increased sharply in Missouri and throughout the Nation in recent years. By 1958, more than 108,000 acres of Missouri land had been planted to forest trees and this total rose to 141,000 in 1961. This acreage falls far short of the estimated 3 million acres in need of planting and seeding.

In general, regeneration is not a major problem in the State's forests. The timber is typically aggressive and when an opening is created it soon is filled with an ample supply of new growing stock. But there are situations where planting and seeding are needed to improve species composition. For example, there is much poorly stocked timberland in the State that is best suited to growing pine but is not restocking to pine because there is no available seed source. Here planting and seeding are recommended.

Planting and seeding are also needed to bring open areas that are suited for forestry into production. Reductions in agriculture and diversions of cropland and pastureland to conservation uses in recent years have left

hundreds of thousands of acres of Missouri land virtually idle. Much of this idle land was originally forest and could be put back into timber production through planting. If all the 3 million acres of plantable land were forested, they could produce more than 1½ million cords of wood per year.

SOUND VOLUME GOES UNUSED IN LOGGING AND MILLING OPERATIONS

About 4.8 million cubic feet or 6 percent of the sound growing stock cut annually for timber products is left in the woods. In Missouri, little integrated logging is practiced. Loggers concentrate on cutting trees for one product and logs that don't meet the size or quality standards for that product are left. The volume left in the woods is greatest where products with rigid quality specifications such as face-veener, cooperage, and handle stock are cut. For example, more than 45 percent of the sound growing-stock volume felled in handle-bolt logging goes unused.

A large amount of wood is also discarded at primary processing plants. About 9.2 million cubic feet of primary plant residues went unused in 1958. Half of this unusued wood was material such as slabs and edgings which are suitable for chipping. The rest consisted of nonchippable material such as sawdust and shavings.

In all, about 14 million cubic feet of logging and primary plant residues go unused each year. To utilize all of this would, of course, be economically impossible but certainly some of it could be used and the possibilities of increasing its utilization are good. New technology has led to increased consumption of chip residues and poor-quality timber. And interest in integrated logging is on the rise. If any of the present waste were eliminated, it would be equivalent to an increase in the net growth rate of Missouri's timber supply.

Timber-Supply Outlook

The outlook for future supplies of timber in Missouri appears favorable. Currently, 78 million cubic feet of growing stock, including 364 million board feet of sawtimber, are being cut each year. The overall demand for timber products is expected to grow and by 1989 the annual cut of timber will probably have increased by more than 50 percent (table 42). But during this same interval, steady increases in annual growth should more than offset increased cutting rates. Annual growth should more than double and become five times greater than the projected cutting rate. By 1989 total timber volume in the State is expected to have increased 149 percent and saw-log volume 125 percent.

The above forecast assumes: (1) the annual timber products output in the United States and Missouri will keep pace with estimated increases in population and national income; (2) Missouri's proportion of the wood market will increase; (3) forestry technology will continue to advance at the rate indicated by recent trends; and (4) continued reforestation, "thickening up" of natural stands, improved cutting practices and forest management, and other changes will lead to a more productive forest resource.

Of course, actual trends can vary from predicted ones. What occurs will depend on such things as the change in demand (both in quantity and quality) for wood products and the effect of present and future forestry programs on the timber supply.

DEMAND FOR MOST FOREST PRODUCTS WILL RISE

Several significant shifts in the demand for Missouri wood products will undoubtedly take place during the next 2 or 3 decades. The output of all timber products from the State is expected to rise from the present annual volume of 149 million cubic feet to 173 million cubic feet by 1989.

Lumber-log output will rise steadily as population increases. By 1989 annual lumber-log production is expected to reach 500 million board feet, a level attained only at the turn of the century and during and immediately following World War II. If forestry continues to progress as fast as in recent years, Missouri's timber will continue to improve, and an increasing volume of larger and higher quality saw logs will be available for cutting. Softwoods should represent an increasing percentage of total output now that pine volume is increasing.

Pulpwood production is expected to rise sharply. Some expansion in production is already noticeable but this is trifling compared with what probably will occur. A plentiful wood supply, proximity to large consumer markets, and a growing emphasis on rural area development are among several favorable factors that make Missouri a prime new target area for the pulpwood industry. Also, improved methods for treating wastes that cause pollution should lower public resistance to the establishment of pulpmills. The addition of just one fair-size pulpmill in Missouri could increase the State's pulpwood output tremendously.

Missouri's charcoal industry, which has boomed in recent years, will probably continue to expand to help satisfy the growing needs of the Nation's outdoor chefs. The supply of wood for charcoal is both plentiful and readily available and plants that are now producing far below their capacity are ready to cope with rising demands. A few operators are improving production techniques. In some plants traditional slow-burning kilns are being re-

placed by steel retorts capable of producing a load of charcoal in a few hours.

Veneer-log production is expected to increase. The use of container veener will probably slacken as substitute materials, such as fiberboard and plastic, claim larger shares of the market. But this reduction will probably be offset by increases in the use of face and commercial veneers for paneling, furniture stock, and specialty items.

There has been concern recently over short supplies of high-quality timber (especially walnut) for the immediate future. Whether or not severe shortages arise will depend primarily on how fast and how much the management and utilization of existing supplies of large hardwood timber are improved. Already, quotas have been tried on exports of walnut logs, and most of the major walnut-using mills have agreed to a revision in the commodity standards for hardwood plywood to provide for the use of thinner face veneers.

Future demand for cooperage is difficult to forecast. More than 90 percent of the cooperage bolts produced in Missouri today are manufactured into liquid-tight containers, primarily bourbon barrels. Present efforts to change Federal regulations concerning the reuse of bourbon barrels, if successful, will reduce the demand for tight cooperage. If Federal regulations remain unchanged, tight-cooperage log production will probably increase to keep up with the consumption rates of an enlarging population. Production of slack cooperage has declined because of competition from the paperboard-container industry. There is little reason to believe that this decline will not continue.

The production of fuelwood, wooden fenceposts, and mine timbers has been decreasing steadily in recent years and will probably continue downward. In the not-so-distant past, wood provided most of Missouri's industrial and domestic fuel needs, but it has rapidly given way to more convenient and better types of fuel. Fuelwood is still important in Missouri where it accounts for half the total output of timber products. But more and more, fuelwood is becoming a luxury item used primarily in residential fireplaces. By 1989 the annual output of fuelwood is expected to be about half that of today. Fencepost production should continue to drop as farms become fewer and larger and improved treating methods lengthen the life of wooden fenceposts. The mining industry has increased its use of steel and of treated mine timbers and, as a result, the ratio of wood used per ton of ore mined has declined steadily in recent years. This trend is expected to continue.

FUTURE SUPPLIES IN THE HANDS OF SMALL-PRIVATE-WOODLAND OWNERS

Recent trends indicate that the area of productive timberland in Missouri will remain relatively constant over the next 2 or 3 decades. Future harvests of timber, then, will have to come primarily from 15 million acres of productive timberland.

About 200,000 private individuals own 90 percent of both the commercial forest land and the sawtimber volume in Missouri. Ninety percent of the tracts are smaller than 100 acres. It is obvious that the management decisions small-private owners make regarding their forest land will largely determine the quantity and quality of future wood supplies. Few small-woodland owners are practicing forestry and their woodlands show it. Opportunities to practice forestry have not been lacking. Farm foresters have been available for technical assistance and incentives have been offered through the Soil Bank and Agricultural Conservation Programs. Many owners are either not aware of the technical and financial assistance available to them or just not interested. Whatever the reasons, this group of individuals with little in common except ownership of a small woodland must be persuaded to put forestry to work on their timberland if supplies of wood for the future are to be adequately provided.

Appendix

FOREST SURVEY PROCEDURE

The data presented in this report were obtained by a sampling procedure used, with some regional variation, by forest survey units throughout the Nation. Information was obtained primarily from aerial photographs and sample plots examined on the ground.

Area

The proportion of forest and nonforest area in Missouri was measured using recent aerial photographs and a transparent dot grid. This involved the photo classification of points scattered over the entire State. Sample points classified as "forest" were examined under a stereoscope and classified as to forest type, size, and stand density. A sample of the stereo-examined points was selected and checked in the field. The ground checks were used to adjust the data on samples that were not ground checked. In all, 283,365 points were photo classified and 3,418 forest points and 1,691 nonforest points were checked on the ground.

A generalized forest type map of the State was drawn by the forest survey field crews as they traveled between ground checkpoints.

Ownership

Forest ownership at each sample location was obtained in the field, if possible, and later checked by examination of county ownership records at county offices.

Volume and Growth

Volume and growth data were computed from tree measurements collected on the ground checkpoints. Groundplots supplied the information on distribution of volume by species and diameter class for each condition class encountered. The resulting per-acre volume and growth multiplied by area yielded total volume and growth figures by species and diameter for each condition class.

Desirable Cut

Harvest cuts were determined by formula after the inventory data had been processed. The formula considers the present area, volume of timber, and growth by stand-size class and forest type, and the liquidation period for each forest type based on rotation age.

Intermediate cuts were determined by field foresters on the sample plots. In making their recommendation fieldmen considered the silvicultural system appropriate for the type and site, the amount of growing stock in the stand, and operability.

Timber Cut

In 1958, the important primary-wood-using plants in the State were asked to estimate their volume of production. All pulp, veneer, cooperage, handle, excelsior, charcoal, and other miscellaneous primary plants were contacted. Lumber production was derived from a sampling survey in cooperation with the Bureau of the Census. Other surveys were conducted to estimate fuelwood and fencepost production. Stump counts made on each sample plot were used to prorate drain by region, timber type, size class, and so forth. Cutting reports were obtained from large-private-timberland owners and public agencies and used to determine timber cut by ownership. Wood utilization studies were made as a basis for adjusting wood production estimates to timber cut in terms of inventory volumes.

ACCURACY OF DATA

Estimates of forest area and timber volume are subject to two kinds of error: sampling errors, arising from the use of sampling procedures; and nonsampling errors, caused by mistakes in judgment, recording of measurements, and calculation.

Sampling errors are measurable errors that are held to a minimum through sampling design. Barring the effects of nonsampling errors, the probabilities are two out of three that the actual areas and volumes are within the standard errors shown in the accompanying tables.

Nonsampling errors are not measurable and their effects are kept at a minimum through supervision, training, and checking of all phases of the work.

Tables I, II, and III can be used to determine the sampling accuracy, both of commercial forest area and of estimates of total volume for the State as a whole and for survey regions.

For example, in Table I the probabilities are two out of three that:

(a) When an area of commercial forest is reported as 1,000,000 acres, the actual acreage is within ±6.2 percent of 1,000,000 acres or between 938,000 and 1,062,000 acres.

(b) The actual volume on an area of 1,000,000 acres will be within ±7.2 percent of the volume estimated for the 1,000,000 acres.

In Table II the probabilities are two out of three that when a volume of growing stock is reported as 1,000,000 cubic feet the actual volume is within ±4.0 percent of 1,000,000 cubic feet or between 960,000 and 1,040,000 cubic feet.

Table I.--Guide for judging accuracy by size of area, Missouri--1959

Commercial forest land (thousand acres)	Standard error of sampling	
	Area	Total volume
	Percent	Percent
15,000	1.6	1.9
10,000	2.0	2.3
5,000	2.8	3.2
1,000	6.2	7.2
500	8.8	10.2
100	20.0	22.8
50	27.8	32.2
25	39.4	45.6
10	62.3	72.1
5	88.1	102.0
2	139.2	161.3

Table II.--Guide for judging volume accuracy, Missouri--1959

Growing stock	
Volume (million cubic feet)	Sampling error
	Percent
1,500.0	3.3
1,000.0	4.0
500.0	5.7
100.0	12.7
50.0	17.9
10.0	40.1
5.0	56.7
2.5	80.2
1.0	126.8
.5	179.3
.2	283.5

Table III.--Guide for judging area and volume accuracy by survey regions, Missouri--1959

Survey Region	Commercial forest land	Standard error of area	Total volume	Standard error of volume
	Thousand acres	Percent	Thousand cubic feet	Percent
Eastern Ozarks	4,333	1.2	1,703,398	1.5
Southwestern Ozarks	3,151	2.8	601,585	3.4
Northwestern Ozarks	2,391	3.9	527,483	4.6
Prairie	2,830	5.8	861,337	6.5
Riverborder	2,272	4.8	932,121	5.2
State total	14,977	1.6	4,625,924	1.9

Note that sampling error for any one class within the State or within a survey region would be much greater than for the State or region as a whole, whether the class considered is type, species, ownership, condition, or other. Generally, the smaller the area or volume the higher the sampling error.

Although subject to large errors, the estimates for small units represent the best available information and can serve as a guide for management of resources.

The occurrence of a (--) in the statistical tables of this report indicates one of two things:

(1) No units were measured by the inventory.

(2) The quantity of data measured was insignificant and did not warrant reporting.

DEFINITION OF TERMS

Land-Use Classes

Land area. — Dry land and land temporarily or partially covered with water, including streams less than ⅛ mile wide and ponds smaller than 40 acres.

Forest land. — Includes areas at least 10 percent stocked with species of forest trees that are capable of producing timber or other wood products, as well as land from which the trees have been removed to less than 10 percent stocking, as long as this land has not been developed for other uses. The minimum size of tract recognized as forest is 1 acre; the minimum width for a wooded strip is 120 feet.

Commercial forest land. — Forest land that is producing or is capable of producing crops of industrial wood (usually saw logs and pulpwood but excluding fuelwood) and is not withdrawn from timber utilization by statute or administrative regulation.

Noncommercial forest land. — (a) Forest land, such as state parks, that qualifies as commercial forest, but is withdrawn from timber utilization through statute, ordinance, or administrative order ("productive-reserved"); or (b) forest land that is incapable of yielding a stand averaging at least one 13-foot saw log per tree ("unproductive forest").

Stand-Size and Stocking Classes

Sawtimber. — Stands having a minimum net volume in live merchantable sawtimber trees of commercial species of 1,500 board feet per acre, International ¼-inch rule (this is equal to approximately 1,300 board feet by the Scribner Decimal C rule).

Poletimber. — Stands failing to meet the specifiications for sawtimber but at least 10 percent stocked with trees 5.0 inches d.b.h. or larger and with at least half of the minimum stocking in poletimber-size trees.

Seedling and sapling (restocking stands). — Stands failing to meet the minimum requirements for either sawtimber or poletimber stands but at least 10 percent stocked with trees of commercial species and at least 5 percent stocked with seedlings and saplings.

Nonstocked. — Areas of commercial forest land not qualifying as sawtimber, poletimber, or seedling and sapling stands. These areas may contain some volume but less than 10 percent of the growing space is effectively utilized by growing stock.

Well stocked. — Stands that are 70 percent or more stocked with present or potential growing-stock trees.

Medium stocked. — Stands that are 40 to 69 percent stocked with present or potential growing-stock trees.

Poorly stocked. — Stands that are from 10 to 39 percent stocked with present or potential growing-stock trees.

Tree Classes

Sawtimber trees. — Live merchantable softwoods 9.0 inches d.b.h. and larger, and hardwoods 11.0 inches d.b.h. and larger.

Poletimber trees. — Trees of softwood species between 5.0 and 8.9 inches d.b.h. and of hardwood species between 5.0 and 10.9 inches d.b.h.

Seedlings and saplings.—Trees less than 5.0 inches d.b.h.

Cull trees. — Live trees of sawtimber or poletimber size with 50 percent or more of the gross volume of the stem unusable due to defects or deformities.

Forest Types

Forest type. — A classification of forest land based upon species composition and named for the species forming a plurality of stocking. Plurality is based on gross cubic volume in sawtimber and poletimber stands, and on the number of trees in seedling and sapling stands. Nonstocked forest land is classified as the forest type best suited to the soil.

Pine. — Stands that are at least 50 percent pine (usually shortleaf pine).

Oak-pine. — Stands that are at least 50 percent hardwood (usually upland oaks), but in which hard pines make up 25 to 49 percent of the stand.

Oak-hickory. — Stands that are at least 50 percent upland oak or hickory, or any combination of them, except where pines comprise 25 to 49 percent of the stand. (Oak-hickory stands have been subtyped and are shown as redcedar, hardwood-redcedar, black-scarlet oak, white oak, and post-blackjack oak in regional statistical reports.)

Oak-gum-cypress. — Bottomland stands containing at least 50 percent tupelo, blackgum, sweetgum, oak, or southern cypress, or any combination of them. (The type is called lowland oak in statistical reports for survey regions where cypress does not occur.)

Elm-ash-cottonwood. — Stands consisting of at least 50 percent elm, ash, or cottonwood, or any combination of them.

Maple-beech. — Stands consisting of at least 50 percent hard maple, beech, or a combination of them.

Species Groups

Softwoods. — Coniferous species including shortleaf pine, redcedar, and cypress.

Soft hardwoods. — Soft-textured, broad-leaved species including elm, soft maple, sweetgum, blackgum, yellow-poplar, cottonwood, and sycamore.

Hard hardwoods. — Firm-textured, broad-leaved species including all of the oaks and hickories, hard maple, birch, black walnut, and ash.

Timber Volume

Net timber volume. — Volume of wood in live merchantable trees from the stump to a minimum diameter inside bark of the central stem, or to a point where the central stem becomes unmerchantable for other reasons.

Growing stock. — Net timber volume of live merchantable sawtimber and poletimber trees from stump to a minimum 4-inch-top diameter inside bark of the central stem. The unpeeled volume in cubic feet was computed from a Lake States Composite Volume Table and corrected for bark thickness by species and diameter class. This volume can be converted to cords by using the factor, 79 cubic feet of peeled wood equals 1 cord of unpeeled wood. This is a standard cord (a stacked pile $4\times4\times8$ feet).

Sawtimber material. — Net timber volume of live merchantable sawtimber between the stump and a point in the top of the stem at which utilization is limited by large branches, forks, or other defects, or by a diameter inside bark of 8 inches (6 inches for softwoods). This volume is expressed in terms of board feet by the International ¼-inch rule which approximates green-lumber tally. Conversion to the Scribner rule may be achieved (roughly) by multiplying volumes by 0.85. Sawtimber volume was computed using a Lake States Composite Volume Table and correcting for form-class differences by species and diameter class. Numerous bark-thickness and form-class measurements were made in Missouri as a means of providing satisfactory corrections for the composite volume tables.

Growth

Net annual growth. — The annual change in the volume of growing stock resulting from natural causes. (Computed on commercial forest land only.)

Growing-stock growth. — Net annual growth of growing-stock trees, expressed in unpeeled cords or cubic feet.

Sawtimber growth. — Net annual growth of sawtimber trees in board feet, International ¼-inch rule.

Mortality

Mortality of growing stock. — The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes.

Desirable Cut

Desirable cut is the net timber volume that may be cut annually during the current decade while (1) progressively developing a reasonably even distribution of age classes during the optimum rotation selected for each type, and (2) progressively improving growing-stock volume and quality to meet the future needs for desired products. The volume includes both harvest and intermediate commercial cuttings (those yielding at least 3 cords total volume or 500 board feet International ¼-inch rule of sawtimber volume). Cull-tree and hardwood-limb volumes are not included. If utilization is closer than anticipated by the Forest Survey desirable cut will increase. A large amount of "high-grading" will reduce the desirable cut.

Desirable cut is based upon forest practices that improve the stands. It must be reduced if timber is allowed to die or overcutting takes place.

Timber Cut

Annual cut of growing stock. — The net annual volume of live sawtimber and poletimber trees cut or killed by damage due to logging, or by land clearing and cultural operations, on commercial forest land.

Annual cut of sawtimber. — The net annual board-foot volume of live sawtimber trees cut or killed by logging, and by land clearing and cultural operations on commercial forest land during a specified year.

Timber products output. — The volume of rough forest products cut from growing stock, cull and dead trees, limbwood, etc.

Logging residues. — The net volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

Plant residues. — Wood materials from primary manufacturing plants that are not utilized for some product.

Coarse residues. — Material suitable for chipping such as slabs, edgings, and veneer cores.

Fine residues. — Material such as sawdust and shavings.

Log Grades

Log grading was done for sawtimber-size trees using the hardwood log grades for standard lumber developed by the Forest Products Laboratory, the standard specifications for logs of southern pines, and the standard specifications for tie-and-timber logs. In grading, the "12-foot rule" was used. Under this rule, the tree is divided into 16-foot sections, insofar as possible, and the best 12-foot portion in each section is graded.

Miscellaneous Definitions

D.b.h. (Diameter at breast height).—Diameter of the tree in inches, outside bark, measured at 4½ feet above the average ground level.

Diameter class. — Where data are presented by 2-inch diameter classes these classes include diameters from 1.0 inch below to 0.9 inch above the stated midpoint; e.g., trees 5.0 inches d.b.h., to and including trees 6.9 inches d.b.h. are included in the 6-inch class. Corresponding limits apply to other diameter classes.

Rotten cull trees. — Nongrowing stock. Fifty percent or more of the gross volume is defective and more than half of the defect is due to rot.

Sound cull trees. — Nongrowing stock. Fifty percent or more of the gross volume is defective but less than half of the defect is due to rot.

Salvable dead trees. — Standing or down dead trees that are considered currently or potentially merchantable.

COMMERCIAL TREE SPECIES

Commercial tree species for which data are presented in the tables of this report are listed below. The common and scientific names are based on "Check List of Native and Naturalized Trees of the United States (including Alaska)" by Elbert L. Little, Jr.[2]

Softwood Species

Cypress (baldcypress)	*Taxodium distichum* (L.) Rich.
Pine (shortleaf)	*Pinus echinata* Mill.
Redcedar (eastern)	*Juniperus virginiana* L.

Hardwood Species

Hard hardwoods:

Ash	*Fraxinus* species
Beech (American)	*Fagus grandifolia* Ehrh.
Birch (river)	*Betula nigra* L.

Hickory Group A —

Shagbark hickory	*Carya ovata* (Mill.) K. Koch
Shellbark hickory	*C. laciniosa* (Michx. f.) Loud.
Mockernut hickory	*C. tomentosa* Nutt.

Hickory Group B —

All other hickories	*Carya* species
Honeylocust	*Gleditsia triancanthos* L.
Locust, black	*Robinia pseudoacacia* L.

Maple (hard) includes —

Black maple	*Acer nigrum* Michx. f.
Sugar maple	*A. saccharum* Marsh.

Oak (red) group includes —

Black oak	*Quercus velutina* Lam.
Blackjack oak	*Q. marilandica* Muenchh.
Cherrybark oak	*Q. Falcata* var. *pagodaefolia* Ell.
Northern red oak	*Q. rubra* L.
Nuttall oak	*Q. nuttallii* Palmer
Pin oak	*Q. palustris* Muenchh.
Scarlet oak	*Q. coccinea Muenchh.*
Shingle oak	*Q. imbricaria* Michx.
Shumard oak	*Q. shumardii* Buckl.
Southern red oak	*Q. falcata* Michx.
Water oak	*Q. nigra* L.
Willow oak	*Q. phellos* L.

Oak (white) group includes —

Bur oak	*Q. macrocarpa* Michx.
Chinkapin oak	*Q. muehlenbergii* Engelm.
Overcup oak	*Q. lyrata* Walt.
Post oak	*Q. stellata* Wangenh.
Swamp chestnut oak	*Q. michauxii* Nutt.
Swamp white oak	*Q. bicolor* Willd.
White oak	*Q. alba* L.

[2]Little, Elbert L., Jr., Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr. Handb. 41, 472 pp. 1953.

Walnut, black ..... *Juglans nigra* L.
Yellowwood ..... *Cladrastis lutea* (Michx. f.) K. Koch

Soft hardwoods:

Basswood (American) ..... *Tilia americana* L.

Blackgum includes —

Black tupelo ..... *Nyssa sylvatica* Marsh.
Water tupelo ..... *N. aquatica* L.
Buckeye (Ohio) ..... *Aesculus glabra* Willd.
Butternut ..... *Juglans cinerea* L.
Cherry (black) ..... *Prunus serotina* Ehrh.
Catalpa (northern) ..... *Catalpa speciosa* Warder
Cottonwood (eastern) ..... *Populus deltoides* Bartr.
Elm ..... *Ulmus* species
Hackberry ..... *Celtis occidentalis* L.
Kentucky coffeetree ..... *Gymnocladus dioicus* (L.) K. Koch
Magnolia (cucumbertree) ..... *Magnolia acuminata* L.

Maple (soft) includes —

Boxelder ..... *Acer negundo* L.
Red maple ..... *A. rubrum* L.
Silver maple ..... *A. saccharinum* L.
Sugarberry ..... *Celtis laevigata* Willd.
Sycamore (American) ..... *Platanus occidentalis* L.
Sweetgum ..... *Liquidambar styraciflua* L.
Willow ..... *Salix* species
Yellow-poplar ..... *Liriodendron tulipifera* L.

TABLES

Table 1.-- *Land area by class and Forest Survey Region, Missouri, 1959*

(In thousand acres)

Land class	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Forest:						
Commercial	14,977	4,333	3,151	2,391	2,831	2,271
Productive reserve	91	26	18	15	17	15
Unproductive	228	34	45	131	13	5
Total forest	15,296	4,393	3,214	2,537	2,861	2,291
Nonforest	*29,008	1,757	2,314	2,521	16,697	5,719
All land	†44,304	6,150	5,528	5,058	19,558	8,010

* Includes 89,000 acres of water according to survey standards of area classification but defined by Bureau of the Census as land.

† From U.S. Bureau of the Census, "Land and Water Area of the United States, 1950."

Table 2. -- *Area of commercial forest land, by ownership class and Forest Survey Region, Missouri, 1959*

(In thousand acres)

Ownership class	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
National Forest	* 1,311	875	317	108	--	11
Other Federal	51	6	8	25	4	8
State	199	169	8	6	1	15
County and municipal	25	4	--	--	21	--
Forest industry	279	261	17	--	--	1
Farmer-owned	9,228	1,636	2,182	1,502	2,199	1,709
Miscellaneous private	3,884	1,382	619	750	606	527
All ownerships	14,977	4,333	3,151	2,391	2,831	2,271

* Includes both operable (812,000 acres) and inoperable (499,000 acres) areas.

Table 3. -- *Area of commercial forest land, by stand-size and ownership classes, Missouri, 1959*

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber	4,086	470	72	74	3,470
Poletimber	4,348	527	97	82	3,642
Seedling and sapling	3,564	187	57	106	3,214
Nonstocked	2,979	127	49	17	2,786
All classes	14,977	1,311	275	279	13,112

Table 4. -- *Area of commercial forest land, by stand-size class and Forest Survey Region, Missouri, 1959*

(In thousand acres)

Stand-size class	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Sawtimber	4,086	1,196	482	366	1,041	1,001
Poletimber	4,348	1,699	787	673	593	596
Seedling & sapling:						
Satisfactorily stocked	1,876	597	507	297	335	140
Poorly stocked	1,688	622	462	258	243	103
Nonstocked	2,979	219	913	797	619	431
All classes	14,977	4,333	3,151	2,391	2,831	2,271

Table 5. -- *Area of commercial forest land, by sawtimber volume and stand-size class, Missouri, 1959*

(In thousand acres)

Volume per acre (board feet) *	All stands	Sawtimber stands	Other stands
Less than 500	7,909	137	7,772
500 to 1,500	4,545	1,541	3,004
1,500 to 5,000	2,410	2,295	115
More than 5,000	113	113	--
Total volume	14,977	4,086	10,891

* Net volume, International 1/4-inch rule.

Table 6. -- *Area of commercial forest land, by stocking class of growing-stock trees and by stand-size class, Missouri, 1959*

(In thousand acres)

Stocking class (percent)	All stands	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked stands
70 or more	1,781	815	409	557	--
40 to 70	4,638	1,647	1,683	1,308	--
10 to 40	5,579	1,624	2,256	1,699	--
Less than 10	2,979	--	--	--	2,979
All classes	14,977	4,086	4,348	3,564	2,979

Table 7. -- *Area of commercial forest land, by forest type and ownership class, Missouri, 1959*

(In thousand acres)

Forest type	All ownerships	Public ownerships	Private ownerships
Pine	330	182	148
Oak-pine	639	290	349
Oak-hickory	11,333	1,057	10,276
Oak-gum-cypress	410	26	384
Elm-ash-cottonwood	2,180	31	2,149
Maple-beech	85	--	85
All types	14,977	1,586	13,391

Table 8. -- *Area of commercial forest land by forest type and stand-size class, Missouri, 1959*

(In thousand acres)

Forest type	All stands	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked stands
Pine	330	119	114	72	25
Oak-pine	639	202	277	143	17
Oak-hickory	11,333	2,690	3,525	2,879	2,239
Oak-gum-cypress	410	195	81	58	76
Elm-ash-cottonwood	2,180	848	312	399	621
Maple-beech	85	32	39	13	1
All types	14,977	4,086	4,348	3,564	2,979

Table 9. -- *Area of commercial forest land, by forest type and Forest Survey Region, Missouri, 1959*

(In thousand acres)

Forest type	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Pine	330	239	64	10	--	17
Oak-pine	639	482	139	4	--	14
Oak-hickory	11,333	3,329	2,833	2,159	1,273	1,739
Oak-gum-cypress	410	114	--	--	162	134
Elm-ash-cottonwood	2,180	127	115	218	1,359	361
Maple-beech	85	42	--	--	37	6
All types	14,977	4,333	3,151	2,391	2,831	2,271

Table 10. -- *Area of noncommercial forest land by forest type, Missouri, 1959*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Oak-pine	2	2	--
Oak-hickory	287	87	200
Oak-gum-cypress	24	1	23
Elm-ash-cottonwood	6	1	5
All types	319	91	228

Table 11. -- *Number of growing-stock trees on commercial forest land by diameter class and major species group, Missouri, 1959*

(In thousand trees)

D.b.h. class (inches)	All species	Softwoods	Hardwoods
2	4,160,600	233,000	3,927,600
4	1,421,400	80,500	1,340,900
6	501,500	36,600	464,900
8	269,900	19,200	250,700
10	145,500	12,500	133,000
12	74,500	2,900	71,600
14	35,300	700	34,600
16	17,400	100	17,300
18	7,700	100	7,600
19-28	8,400	100	8,300
29-38	300	--	300
Total	6,642,500	385,700	6,256,800

Table 12. -- *Number of cull trees on commercial forest land, by diameter class and major species group, Missouri, 1959*

(In thousand trees)

D.b.h. class (inches)	Cull trees
Softwoods:	
5.0 - 8.9	6,900
9.0 - 18.9	1,500
19.0 +	--
Total softwoods	8,400
Hardwoods:	
5.0 - 10.9	322,000
11.0 - 18.9	100,800
19.0 +	15,600
Total hardwoods	438,400
All species	446,800

Table 13. -- *Net volume of growing stock, by species and Forest Survey Region, Missouri, 1959*

(In thousand cords)

Species	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Softwoods:						
Pine, shortleaf	3,503	2,923	497	27	--	56
Cypress	92	31	--	--	--	61
Redcedar	220	50	54	23	1	92
All softwoods	3,815	3,004	551	50	1	209
Hard hardwoods:						
Oak, white	12,248	3,817	1,404	1,431	1,546	4,050
Oak, post	6,757	2,268	1,258	1,593	553	1,085
Oak, other white	1,424	147	67	107	743	360
Oak, black	10,770	5,023	2,024	1,803	798	1,122
Oak, scarlet	2,695	2,554	100	9	12	20
Oak, northern red	2,782	766	442	254	551	769
Oak, other red	2,551	817	304	223	675	532
Hickory, Group A	2,592	956	260	139	743	494
Hickory, Group B	2,508	951	533	301	208	515
Maple, hard	524	173	25	7	88	231
Birch	156	17	1	--	125	13
Walnut, black	1,188	96	148	182	616	146
Ash	985	99	82	27	351	426
Other hard hardwoods	1,925	169	70	138	883	665
All hard hardwoods	49,105	17,853	6,718	6,214	7,892	10,428
Soft hardwoods:						
Elm	3,271	302	225	240	1,966	538
Maple, soft	585	26	--	17	441	101
Sweetgum	301	151	--	--	--	150
Blackgum	225	118	55	--	--	52
Yellow-poplar	19	--	--	--	--	19
Cottonwood	391	18	--	--	297	76
Other soft hardwoods*	844	90	66	156	306	226
All soft hardwoods	5,636	705	346	413	3,010	1,162
All hardwoods	54,741	18,558	7,064	6,627	10,902	11,590
All species	58,556	21,562	7,615	6,677	10,903	11,799

* Mainly sycamore.

Table 14. -- *Net volume of live timber on commercial forest land, by class of timber and major species group, Missouri, 1959*

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber:			
Saw log portion	1,944	118	1,826
Upper stem portion	168	47	121
Total sawtimber	2,112	165	1,947
Poletimber	2,514	136	2,378
Total growing stock	4,626	301	4,325
Sound cull:			
Sawtimber-size	245	7	238
Poletimber-size	243	5	238
Total sound cull	488	12	476
Rotten cull:			
Sawtimber-size	447	1	446
Poletimber-size	154	--	154
Total rotten cull	601	1	600
All classes	5,715	314	5,401

Table 15. -- *Net volume of growing stock, sawtimber, and poletimber on commercial forest land, by species, Missouri, 1959*

Species	Growing stock	Sawtimber	Poletimber
	Thousand cords	*Million board feet**	*Thousand cords*
Softwoods:			
Pine, shortleaf	3,503	702	1,515
Cypress	92	41	4
Redcedar	220	6	198
All softwoods	3,815	749	1,717
Hard hardwoods:			
Oak, white	12,248	2,663	6,452
Oak, post	6,757	985	4,513
Oak, other white	1,424	356	667
Oak, black	10,770	2,021	6,278
Oak, scarlet	2,695	417	1,672
Oak, northern red	2,782	844	1,016
Oak, other red	2,551	533	1,417
Hickory, Group A	2,592	486	1,568
Hickory, Group B	2,508	337	1,781
Maple, hard	524	115	284
Birch	156	40	68
Walnut, black	1,188	307	524
Ash	985	180	590
Other hard hardwoods	1,925	381	1,123
All hard hardwoods	49,105	9,665	27,953
Soft hardwoods:			
Elm	3,271	889	1,499
Maple, soft	585	200	171
Sweetgum	301	68	153
Blackgum	225	57	75
Yellow-poplar	19	4	10
Cottonwood	391	170	41
Other soft hardwoods †	844	306	196
All soft hardwoods	5,636	1,694	2,145
All hardwoods	54,741	11,359	30,098
All species	58,556	12,108	31,815

* International 1/4-inch rule.
† Mainly sycamore.

Table 16. -- *Net volume of growing stock and sawtimber on commercial forest land, by ownership class and major species group, Missouri, 1959*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million board feet**	*Million board feet**	*Million board feet**
National Forest	652	156	496	1,241	413	828
Other public	87	6	81	193	14	179
Forest industry	92	8	84	193	20	173
Farmer and misc. private	3,795	131	3,664	10,481	302	10,179
All classes	4,626	301	4,325	12,108	749	11,359

* International 1/4-inch rule.

Table 17. -- *Net volume of growing stock and sawtimber on commercial forest land, by stand-size class and major species group, Missouri, 1959*

Stand-size class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million board feet**	*Million board feet**	*Million board feet**
Sawtimber	2,223	126	2,097	8,472	448	8,024
Poletimber	1,677	135	1,542	1,930	176	1,754
Seedlings and saplings	454	30	424	1,060	101	959
Nonstocked	272	10	262	646	24	622
All classes	4,626	301	4,325	12,108	749	11,359

* International 1/4-inch rule.

Table 18. -- *Net volume of growing stock on commercial forest land, by species and diameter class, Missouri, 1959*

(In million cubic feet)

Species	Diameter class (inches)													
	Total	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
Softwoods:														
Pine, shortleaf	277	48	73	94	37	18	3	3	1	--	--	--	--	--
Cypress	7	--	--	--	--	--	2	1	3	1	--	--	--	--
Redcedar	17	9	6	2	--	--	--	--	--	--	--	--	--	--
All softwoods	301	57	79	96	37	18	5	4	4	1	--	--	--	--
Hard hardwoods:														
Oak, white	968	133	192	185	185	133	69	33	16	8	6	4	1	3
Oak, post	534	125	122	109	85	51	24	8	5	3	2	--	--	--
Oak, other white	113	15	19	19	12	9	9	7	7	5	4	3	1	3
Oak, black	851	134	183	179	118	88	49	41	27	14	7	6	2	3
Oak, scarlet	213	29	49	55	39	23	12	5	1	--	--	--	--	--
Oak, northern red	220	18	29	33	37	27	32	11	10	8	7	5	2	1
Oak, other red	201	40	44	28	23	17	11	10	9	7	4	4	1	3
Hickory, Group A	205	47	46	32	21	16	13	15	8	3	2	1	1	--
Hickory, Group B	198	53	49	39	23	15	11	5	1	--	1	--	--	1
Maple, hard	41	7	5	9	6	4	3	1	1	3	1	1	--	--
Birch	12	2	1	2	1	1	3	--	1	1	--	--	--	--
Walnut, black	94	13	12	17	18	18	8	4	2	2	--	--	--	--
Ash	78	17	15	15	7	7	8	4	2	1	1	--	1	--
Other hard hardwoods	152	31	32	25	19	15	15	5	4	1	3	2	--	--
All hard hardwoods	3,880	664	798	747	594	424	267	149	94	56	38	26	9	14
Soft hardwoods:														
Elm	258	40	43	36	35	21	25	16	12	11	10	5	--	4
Maple, soft	46	3	1	9	7	4	7	7	3	2	--	--	1	2
Sweetgum	24	3	5	4	3	2	2	2	1	--	--	1	1	--
Blackgum	18	2	2	2	2	3	3	2	2	--	--	--	--	--
Yellow-poplar	1	--	1	--	--	--	--	--	--	--	--	--	--	--
Cottonwood	31	1	2	--	2	1	2	4	2	4	5	3	1	4
Other soft hardwoods*	67	3	7	5	8	5	10	4	10	4	3	1	1	6
All soft hardwoods	445	52	61	56	57	36	49	35	30	21	18	10	4	16
All hardwoods	4,325	716	859	803	651	460	316	184	124	77	56	36	13	30
All species	4,626	773	938	899	688	478	321	188	128	78	56	36	13	30

* Mainly sycamore.

Table 19. -- *Net volume of sawtimber on commercial forest land, by species and diameter class, Missouri, 1959*

(In million board feet)*

Species	Total	Diameter class (inches)										
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
Softwoods:												
Pine, shortleaf	702	336	172	144	15	29	6	--	--	--	--	--
Cypress	41	1	2	--	6	5	13	7	4	1	1	1
Redcedar	6	3	1	2	--	--	--	--	--	--	--	--
All softwoods	749	340	175	146	21	34	19	7	4	1	1	1
Hard hardwoods:												
Oak, white	2,663	--	1,053	780	420	194	94	45	34	22	4	17
Oak, post	985	--	463	289	136	44	26	14	9	3	1	--
Oak, other white	356	--	72	53	61	34	41	29	25	15	8	18
Oak, black	2,021	--	648	495	284	252	158	85	41	34	9	15
Oak, scarlet	417	--	191	126	62	26	6	1	3	2	--	--
Oak, northern red	844	--	216	166	193	72	63	47	43	26	11	7
Oak, other red	533	--	134	97	67	57	57	41	29	26	5	20
Hickory, Group A	486	--	117	100	81	91	48	19	13	10	7	--
Hickory, Group B	337	--	131	84	66	29	11	3	5	--	3	5
Maple, hard	115	--	33	26	14	9	7	15	5	5	--	1
Birch	40	--	5	6	17	--	8	4	--	--	--	--
Walnut, black	307	--	97	108	46	25	17	12	--	2	--	--
Ash	180	--	40	39	44	28	12	5	8	--	4	--
Other hard hardwoods	381	--	109	88	99	35	22	5	16	6	--	1
All hard hardwoods	9,665	--	3,309	2,457	1,590	896	570	325	231	151	52	84
Soft hardwoods:												
Elm	889	--	230	137	167	96	77	65	60	29	3	25
Maple, soft	200	--	37	25	41	46	21	13	3	--	4	10
Sweetgum	68	--	15	13	11	11	7	3	1	4	3	--
Blackgum	57	--	7	14	17	11	7	--	1	--	--	--
Yellow-poplar	4	--	2	2	--	--	--	--	--	--	--	--
Cottonwood	170	--	7	4	15	24	14	23	33	20	5	25
Other soft hardwoods†	306	--	45	31	63	24	62	28	15	7	6	25
All soft hardwoods	1,694	--	343	226	314	212	188	132	113	60	21	85
All hardwoods	11,359	--	3,652	2,683	1,904	1,108	758	457	344	211	73	169
All species	12,108	340	3,827	2,829	1,925	1,142	777	464	348	212	74	170

* International 1/4-inch rule.
† Mainly sycamore.

Table 20. -- *Net volume of sawtimber on commercial forest land, by species and Forest Survey Region, Missouri, 1959*

(In million board feet)*

Species	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Softwoods:						
Pine, shortleaf	701.7	551.6	132.8	6.0	--	11.3
Cypress	41.1	12.9	--	--	--	28.2
Redcedar	6.6	1.6	2.7	--	.1	2.2
All softwoods	749.4	566.1	135.5	6.0	.1	41.7
Hard hardwoods:						
Oak, white	2,662.9	576.5	266.9	285.8	459.3	1,074.4
Oak, post	984.9	321.7	206.6	202.5	104.6	149.5
Oak, other white	356.4	20.0	15.1	13.4	209.9	98.0
Oak, black	2,020.9	708.4	435.4	359.3	180.2	337.6
Oak, scarlet	416.7	389.1	20.2	3.3	--	4.1
Oak, northern red	843.6	135.8	113.7	88.1	202.6	303.4
Oak, other red	533.5	117.5	18.5	25.4	195.3	176.8
Hickory, Group A	485.7	125.1	38.3	29.8	184.6	107.9
Hickory, Group B	336.8	116.0	66.8	31.4	27.2	95.4
Maple, hard	115.4	38.3	6.2	1.3	26.5	43.1
Birch	40.2	.9	--	--	38.8	.5
Walnut, black	306.8	5.5	37.3	37.6	190.3	36.1
Ash	180.3	14.5	18.0	4.9	53.9	89.0
Other hard hardwoods	381.3	37.4	12.7	18.3	154.6	158.3
All hard hardwoods	9,665.4	2,606.7	1,255.7	1,101.1	2,027.8	2,674.1
Soft hardwoods:						
Elm	888.6	42.5	51.5	51.2	612.2	131.2
Maple, soft	199.6	6.3	--	2.6	154.6	36.1
Sweetgum	67.7	21.5	--	--	--	46.2
Blackgum	57.3	24.2	18.2	--	--	14.9
Yellow-poplar	4.1	--	--	--	--	4.1
Cottonwood	170.0	5.0	--	.1	129.6	35.3
Other soft hardwoods†	306.4	26.2	14.8	40.6	134.6	90.2
All soft hardwoods	1,693.7	125.7	84.5	94.5	1,031.0	358.0
All hardwoods	11,359.1	2,732.4	1,340.2	1,195.6	3,058.8	3,032.1
All species	12,108.5	3,298.5	1,475.7	1,201.6	3,058.9	3,073.8

* International 1/4-inch rule.
† Mainly sycamore.

Table 21. -- *Net volume of sawtimber by species and Forest Survey Region, Missouri, 1947 and 1959*

(In million board feet)*

Species	All Regions		Eastern Ozarks		Southwestern Ozarks		Northwestern Ozarks		Prairie		Riverborder	
	1947	1959	1947	1959	1947	1959	1947	1959	1947	1959	1947	1959
Softwoods:												
Pine, shortleaf	483	701.7	291	551.6	171	132.8	--	6.0	--	--	21	11.3
Other softwoods	246	47.7	20	14.5	4	2.7	1	--	6	0.1	215	30.4
All softwoods	729	749.4	311	566.1	175	135.5	1	6.0	6	0.1	236	41.7
Hard hardwoods:												
Oak, white	2,535	2,662.9	556	576.5	362	266.9	305	285.8	459	459.3	853	1,074.4
Oak, other white	1,426	1,341.3	343	341.7	357	221.7	257	215.9	295	314.5	174	247.5
Oak, black	2,145	2,020.9	712	708.4	627	435.4	384	359.3	182	180.2	240	337.6
Oak, other red	1,432	1,793.8	557	642.4	149	152.4	133	116.8	243	397.9	350	484.3
Hickory	698	822.5	223	241.1	99	105.1	72	61.2	147	211.8	157	203.3
Walnut, black	260	306.8	6	5.5	34	37.3	29	37.6	159	190.3	32	36.1
Other hard hardwoods	642	717.2	89	91.1	41	36.9	42	24.5	244	273.8	226	290.9
All hard hardwoods	9,138	9,665.4	2,486	2,606.7	1,669	1,255.7	1,222	1,101.1	1,729	2,027.8	2,032	2,674.1
Soft hardwoods:												
Elm	821	888.6	67	42.5	44	51.5	53	51.2	469	612.2	188	131.2
Other soft hardwoods	1,210	805.1	198	83.2	88	33.0	82	43.3	471	418.8	371	226.8
All soft hardwoods	2,031	1,693.7	265	125.7	132	84.5	135	94.5	940	1,031.0	559	358.0
All hardwoods	11,169	11,359.1	2,751	2,732.4	1,801	1,340.2	1,357	1,195.6	2,669	3,058.8	2,591	3,032.1
All species	11,898	12,108.5	3,062	3,298.5	1,976	1,475.7	1,358	1,201.6	2,675	3,058.9	2,827	3,073.8

* International 1/4-inch rule.

Table 22. -- *Net volume of sawtimber on commercial forest land, by species and log grade, Missouri, 1959*

(In million board feet)*

Species	All grades	Log grades		
		I and II †	III	Tie and timber
Softwoods:				
Pine, shortleaf	702	284	418	--
Cypress	41	12	29	--
Redcedar	6	--	6	--
All softwoods	749	296	453	--
Hard hardwoods:				
Oak, white	2,663	327	1,104	1,232
Oak, post	985	167	197	621
Oak, other white	356	61	60	235
Oak, black	2,021	260	596	1,165
Oak, scarlet	417	19	99	299
Oak, northern red	844	226	213	405
Oak, other red	533	46	101	386
Hickory, Group A	486	22	122	342
Hickory, Group B	337	44	100	193
Maple, hard	115	5	2	108
Birch	40	--	--	40
Walnut, black	307	68	165	74
Ash	180	66	42	72
Other hard hardwoods	381	37	96	248
All hard hardwoods	9,665	1,348	2,897	5,420
Soft hardwoods:				
Elm	889	124	136	629
Maple, soft	200	14	39	147
Sweetgum	68	10	20	38
Blackgum	57	23	3	31
Yellow-poplar	4	--	--	4
Cottonwood	170	29	13	128
Other soft hardwoods‡	306	112	79	115
All soft hardwoods	1,694	312	290	1,092
All hardwoods	11,359	1,660	3,187	6,512
All species	12,108	1,956	3,640	6, 512

* International 1/4-inch rule.

† Approximately 14 percent of all the Log Grade I and II volume in the State is Grade I material.

‡ Mainly sycamore.

Table 23. -- *Net annual growth of growing stock, sawtimber, and poletimber on commercial forest land, by species, Missouri, 1959*

Species	Growing stock	Sawtimber*	Poletimber†
	Thousand cords	*Million board feet‡*	*Thousand cords*
Softwoods:			
Pine, shortleaf	198	71	120
Cypress	1	--	--
Redcedar	42	2	41
All softwoods	241	73	161
Hard hardwoods:			
Oak, white	597	184	454
Oak, post	304	60	274
Oak, other white	80	22	67
Oak, black	309	84	303
Oak, scarlet	172	49	137
Oak, northern red	100	38	64
Oak, other red	138	11	147
Hickory, Group A	112	23	90
Hickory, Group B	168	25	154
Maple, hard	23	6	17
Birch	8	3	4
Walnut, black	150	43	117
Ash	57	10	48
Other hard hardwoods	221	30	215
All hard hardwoods	2,439	588	2,091
Soft hardwoods:			
Elm	301	65	263
Maple, soft	24	14	14
Sweetgum	24	7	18
Blackgum	19	5	11
Yellow-poplar	1	--	1
Cottonwood	8	2	4
Sycamore	10	4	8
All soft hardwoods	387	97	319
All hardwoods	2,826	685	2,410
All species	3,067	758	2,571

* Includes ingrowth of poletimber trees.
† Includes ingrowth of seedlings and saplings.
‡ International 1/4-inch rule.

Table 24. ---*Annual desirable cut of growing stock, sawtimber, and poletimber on commercial forest land, by species, Missouri, 1959*

Species	Growing stock	Sawtimber	Poletimber
	Thousand cords	*Million board feet**	*Thousand cords*
Softwoods:			
Pine, shortleaf	58	12	24
Cypress	4	2	--
Redcedar	4	--	3
All softwoods	66	14	27
Hard hardwoods:			
Oak, white	429	117	174
Oak, post	282	52	161
Oak, other white	61	16	27
Oak, black	326	82	139
Oak, scarlet	91	21	39
Oak, northern red	121	44	28
Oak, other red	77	15	47
Hickory, Group A	110	26	54
Hickory, Group B	95	19	54
Maple, hard	24	6	12
Birch	8	2	4
Walnut, black	24	6	10
Ash	38	6	25
Other hard hardwoods	79	15	48
All hard hardwoods	1,765	427	822
Soft hardwoods:			
Elm	160	39	81
Maple, soft	27	9	9
Sweetgum	10	3	4
Blackgum	12	3	5
Yellow-poplar	--	--	--
Cottonwood	17	8	--
Other soft hardwoods†	18	6	4
All soft hardwoods	244	68	103
All hardwoods	2,009	495	925
All species	2,075	509	952

* International 1/4-inch rule.
† Mainly sycamore.

Table 25. -- *Annual desirable cut of growing stock on commercial forest land, by species and Forest Survey Region, Missouri, 1959*

(In thousand cords)

Species	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Softwoods:						
Pine, shortleaf	58	49	9	--	--	--
Cypress	4	1	--	--	--	3
Redcedar	4	2	1	--	--	1
All softwoods	66	52	10	--	--	4
Hard hardwoods:						
Oak, white	429	125	62	45	55	142
Oak, post	282	106	54	40	24	58
Oak, other white	61	5	4	4	29	19
Oak, black	326	174	46	62	16	28
Oak, scarlet	91	87	4	--	--	--
Oak, northern red	121	32	22	7	24	36
Oak, other red	77	34	10	3	14	16
Hickory, Group A	110	52	13	6	22	17
Hickory, Group B	95	46	20	8	7	14
Maple, hard	24	11	1	--	5	7
Birch	8	--	--	--	8	--
Walnut, black	24	5	2	2	10	5
Ash	38	8	3	--	14	13
Other hard hardwoods	79	9	--	7	30	33
All hard hardwoods	1,765	694	241	184	258	388
Soft hardwoods:						
Elm	160	17	13	11	99	20
Maple, soft	27	1	--	--	19	7
Sweetgum	10	6	--	--	--	4
Blackgum	12	8	3	--	--	1
Yellow-poplar	--	--	--	--	--	--
Cottonwood	17	1	--	--	14	2
Other soft hardwoods*	18	4	2	3	5	4
All soft hardwoods	244	37	18	14	137	38
All hardwoods	2,009	731	259	198	395	426
All species	2,075	783	269	198	395	430

* Mainly sycamore

Table 26. -- *Annual desirable cut of sawtimber on commercial forest land, by species and Forest Survey Region, Missouri, 1959*

(In million board feet)*

Species	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Softwoods:						
Pine, shortleaf	12.0	9.6	2.4	--	--	--
Cypress	2.0	.6	--	--	--	1.4
Redcedar	.1	--	.1	--	--	--
All softwoods	14.1	10.2	2.5	--	--	1.4
Hard hardwoods:						
Oak, white	116.8	26.7	15.2	11.8	17.0	46.1
Oak, post	52.3	17.8	11.0	6.1	7.2	10.2
Oak, other white	16.0	.6	.9	.5	9.2	4.8
Oak, black	82.4	36.7	8.8	18.9	6.3	11.7
Oak, scarlet	21.2	20.1	1.0	--	--	.1
Oak, northern red	44.3	7.4	6.8	3.0	11.0	16.1
Oak, other red	14.5	4.1	.9	.1	4.8	4.6
Hickory, Group A	25.7	10.3	3.2	1.3	6.6	4.3
Hickory, Group B	18.6	8.9	3.0	1.9	1.2	3.6
Maple, hard	5.6	3.1	.2	--	.6	1.7
Birch	1.7	--	--	--	1.7	--
Walnut, black	6.4	.4	.6	.6	3.9	.9
Ash	6.2	.8	.7	--	1.4	3.3
Other hard hardwoods	14.8	2.1	.1	1.1	4.4	7.1
All hard hardwoods	426.5	139.0	52.4	45.3	75.3	114.5
Soft hardwoods:						
Elm	39.4	2.6	4.1	2.6	25.5	4.6
Maple, soft	9.0	.2	--	.2	6.9	1.7
Sweetgum	2.6	1.1	--	--	--	1.5
Blackgum	2.8	1.7	.8	--	--	.3
Yellow-poplar	--	--	--	--	--	--
Cottonwood	8.0	.1	--	--	6.9	1.0
Other soft hardwoods†	6.6	1.4	.5	1.0	2.2	1.5
All soft hardwoods	68.4	7.1	5.4	3.8	41.5	10.6
All hardwoods	494.9	146.1	57.8	49.1	116.8	125.1
All species	509.0	156.3	60.3	49.1	116.8	126.5

* International 1/4-inch rule.
† Mainly sycamore.

Table 27. -- *Annual mortality of growing stock and sawtimber on commercial forest land, by species, Missouri, 1959*

Species	Growing stock	Sawtimber
	Million cubic feet	*Million board feet**
Softwoods:		
Pine, shortleaf	1	--
Other softwoods	--	--
All softwoods	1	--
Hard hardwoods:		
Oak, white	5	15
Oak, post	6	19
Oak, other white	1	5
Oak, black	22	84
Oak, scarlet	6	14
Oak, northern red	2	8
Oak, other red	11	29
Hickory, Group A	1	6
Hickory, Group B	3	8
Maple, hard	--	1
Walnut, black	1	2
Ash	1	1
Other hard hardwoods	3	11
All hard hardwoods	62	203
Soft hardwoods:		
Elm	3	17
Maple, soft	1	4
Other soft hardwoods	--	--
Sycamore	1	3
All soft hardwoods	5	24
All hardwoods	67	227
All species	68	227

* International 1/4-inch rule.

Table 28. -- *Annual mortality of growing stock and sawtimber on commercial forest land by cause of death and major species group, Missouri, 1959*

Cause of death	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million board feet**	*Million board feet**	*Million board feet**
Fire	6	--	6	20	--	20
Insects	--	--	--	1	--	1
Disease	18	--	18	68	--	68
Weather, suppression and animals	27	1	26	72	--	72
Unknown	17	--	17	66	--	66
All causes	68	1	67	227	--	227

* International 1/4-inch rule.

Table 29. -- *Net annual growth, annual desirable cut, and annual cut of growing stock on commercial forest land, by species, Missouri, 1959*

(In million cubic feet)

Species	Net annual growth	Annual desirable cut	Annual timber cut*
Softwoods:			
Pine, shortleaf	15	5	5
Cypress	1	--	--
Redcedar	3	--	--
All softwoods	19	5	5
Hard hardwoods:			
Oak, white	47	34	23
Oak, post	24	22	12
Oak, other white	6	5	3
Oak, black	24	26	12
Oak, scarlet	14	7	2
Oak, northern red	8	10	3
Oak, other red	11	6	2
Hickory, Group A	9	9	3
Hickory, Group B	13	7	--
Maple, hard	2	2	1
Birch	1	1	--
Walnut, black	12	2	1
Ash	4	3	1
Other hard hardwoods	18	6	2
All hard hardwoods	193	140	65
Soft hardwoods:			
Elm	24	13	2
Maple, soft	2	2	1
Sweetgum	2	1	--
Blackgum	1	1	1
Yellow-poplar	--	--	--
Cottonwood	--	1	3
Other soft hardwoods†	1	1	1
All soft hardwoods	30	19	8
All hardwoods	223	159	73
All species	242	164	78

* Based on survey of timber cut conducted for 1958.
† Mainly sycamore.

Table 30. -- *Net annual growth and annual cut of growing stock on commercial forest land, by ownership classes and by major species group, Missouri, 1959*

(In million cubic feet)

NET ANNUAL GROWTH

Species group	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods	19	10	--	1	8
Hardwoods	223	28	4	4	187
All species	242	38	4	5	195

ANNUAL TIMBER CUT*

Softwoods	5	1	--	--	4
Hardwoods	73	4	--	2	67
All species	78	5	--	2	71

* Based on survey of timber cut conducted for 1958.

Table 31. -- *Net annual growth, annual desirable cut, and annual cut of sawtimber on commercial forest land, by species, Missouri, 1959*

(In million board feet)*

Species	Net annual growth	Annual desirable cut	Annual timber cut†
Softwoods:			
Pine, shortleaf	71	12	21
Cypress	--	2	1
Redcedar	2	--	1
All softwoods	73	14	23
Hard hardwoods:			
Oak, white	184	117	112
Oak, post	60	52	41
Oak, other white	22	16	15
Oak, black	84	82	61
Oak, scarlet	49	21	12
Oak, northern red	38	44	14
Oak, other red	11	15	11
Hickory, Group A	23	26	11
Hickory, Group B	25	19	2
Maple, hard	6	6	2
Birch	3	2	--
Walnut, black	43	6	8
Ash	10	6	2
Other hard hardwoods	30	15	8
All hard hardwoods	588	427	299
Soft hardwoods:			
Elm	65	39	9
Maple, soft	14	9	3
Sweetgum	7	3	2
Blackgum	5	3	3
Yellow-poplar	--	--	2
Cottonwood	2	8	16
Other soft hardwoods‡	4	6	7
All soft hardwoods	97	68	42
All hardwoods	685	495	341
All species	758	509	364

* International 1/4-inch rule.

† Based on survey of timber cut conducted for 1958.

‡ Mainly sycamore.

Table 32. -- *Net annual growth and annual cut of sawtimber on commercial forest land, by ownership class and by major species group, Missouri, 1959*

(In million board feet)*

NET ANNUAL GROWTH

Species group	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods	73	42	1	2	28
Hardwoods	685	81	10	9	585
All species	758	123	11	11	613
ANNUAL TIMBER CUT†					
Softwoods	23	3	--	1	19
Hardwoods	341	24	2	8	307
All species	364	27	2	9	326

* International 1/4-inch rule.
† Based on survey of timber cut conducted for 1958.

Table 33. -- *Annual timber cut from growing stock on commercial forest land, by products and logging residues, and by major species group, Missouri, 1958*

(In thousand cubic feet)

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	34,271	4,114	30,157
Veneer logs and bolts	883	--	883
Cooperage logs and bolts	2,960	--	2,960
Handle stock	1,048	--	1,048
Pulpwood	571	113	458
Poles	186	186	--
Mine timbers	360	9	351
Miscellaneous industrial wood*	6,631	39	6,592
Posts	6,518	539	5,979
Fuelwood	19,619	72	19,547
All products	73,047	5,072	67,975
Logging residues	4,801	251	4,550
Timber cut	77,848	5,323	72,525

* Charcoal, excelsior wood, farm timbers, hewn ties, etc.

Table 34. -- *Annual timber cut of sawtimber on commercial forest land, by products and logging residues, and by major species group, Missouri, 1958*

(In thousand board feet)*

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	214,400	21,104	193,296
Veneer logs and bolts	6,277	--	6,277
Cooperage logs and bolts	20,519	--	20,519
Handle stock	5,083	--	5,083
Pulpwood	2,727	415	2,312
Poles	310	310	--
Mine timbers	383	9	374
Miscellaneous industrial wood†	30,070	210	29,860
Posts	17,866	321	17,545
Fuelwood	46,667	171	46,496
All products	344,302	22,540	321,762
Logging residues	19,958	305	19,653
Timber cut	364,260	22,845	341,415

* International 1/4-inch rule.
† Charcoal, excelsior wood, farm timbers, hewn ties, etc.

Table 35. -- *Annual cut of growing stock and sawtimber on commercial forest land, by major species group and Forest Survey Region, Missouri, 1958*

GROWING STOCK

(In thousand cords)

Species group	All Regions	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Prairie	Riverborder
Softwoods	67.5	31.1	31.9	--	--	4.5
Hard hardwoods	822.9	203.4	226.6	104.6	93.8	194.5
Soft hardwoods	96.2	18.7	9.0	--	49.3	19.2
Total growing stock	986.6	253.2	267.5	104.6	143.1	218.2

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(In million board feet)*

Softwoods	22.9	9.7	11.7	--	--	1.5
Hard hardwoods	299.1	77.4	80.2	23.4	37.8	80.3
Soft hardwoods	42.3	9.4	3.9	--	21.2	7.8
Total sawtimber	364.3	96.5	95.8	23.4	59.0	89.6

* International 1/4-inch rule.

Table 36. -- *Timber cut from commercial forest land, by major species group and diameter class, Missouri, 1958*

(In thousand cords)

Species group	All Classes	Tree diameter class (inches)			
		6-10	12-14	16-18	20+
Softwoods	67.5	46.9	18.4	0.8	1.4
Oaks	722.5	166.2	197.1	227.7	131.5
Other hard hardwoods	100.4	29.2	26.5	26.3	18.4
Soft hardwoods	96.2	12.5	17.0	27.3	39.4
All species	986.6	254.8	259.0	282.1	190.7

Table 37. -- *Timber cut in 1946 and 1958 by major species group, Missouri*

Species group	Growing stock			Sawtimber		
	1946	1958	Change	1946	1958	Change
	Thousand cubic feet	*Thousand cubic feet*	*Percent*	*Thousand board feet**	*Thousand board feet**	*Percent*
Softwoods	11,196	5,323	−52	57,524	22,845	−60
White oaks	40,908	38,500	− 6	169,502	168,489	− 1
Red oaks	65,288	18,559	−72	307,768	97,590	−68
Other hardwoods	32,269	15,466	−52	133,406	75,336	−44
All species	149,661	77,848	−48	668,200	364,260	−45

* International 1/4-inch rule.

Table 38. -- *Timber cut in 1946 and 1958 by timber product, Missouri*

Product	Growing stock			Sawtimber		
	1946	1958	Change	1946	1958	Change
	Thousand cubic feet	*Thousand cubic feet*	*Percent*	*Thousand board feet**	*Thousand board feet**	*Percent*
Saw logs	82,115	37,502	−54	480,611	228,743	−52
Veneer logs and bolts	1,470	930	−37	9,554	6,442	−33
Cooperage logs and bolts	15,470	3,359	−78	100,557	22,737	−77
Handle stock	1,355	1,923	+42	8,808	7,405	−16
Pulpwood	337	595	+77	1,173	2,865	+144
Poles	40	186	+365	--	310	--
Mine timbers	3,360	399	−88	--	417	--
Miscellaneous industrial wood†	2,817	6,817	+142	9,214	30,808	+234
Posts	8,381	6,518	−22	25,456	17,866	−30
Fuelwood	34,316	19,619	−43	32,827	46,667	+42
All products	149,661	77,848	−48	668,200	364,260	−45

* International 1/4-inch rule.

† Charcoal, excelsior wood, farm timbers, hewn ties, etc.

Table 39. -- *Total output of timber products, by product, type of material used, and species class, Missouri, 1958*

Product and species group	Total output in standard units		Output from roundwood		Output from plant by-products (standard units)
	Unit	Number	Standard units	Thousand cu. ft.	
Saw logs and saw bolts:					
Softwoods	M. bd. ft.*	26,886	26,886	4,114	--
Hardwoods	M. bd. ft.*	287,216	287,216	43,654	--
Total	M. bd. ft.*	314,102	314,102	47,768	--
Veneer logs and bolts:					
Softwoods	M. bd. ft.	--	--	--	--
Hardwoods	M. bd. ft.	7,132	7,132	1,012	--
Total	M. bd. ft.	7,132	7,132	1,012	--
Cooperage logs and bolts:					
Softwoods	M. bd. ft.	--	--	--	--
Hardwoods	M. bd. ft.	30,811	30,811	4,498	--
Total	M. bd. ft.	30,811	30,811	4,498	
Handle stock:					
Softwoods	M. bd. ft.	--	--	--	--
Hardwoods	M. bd. ft.	7,281	7,281	1,173	--
Total	M. bd. ft.	7,281	7,281	1,173	
Pulpwood:					
Softwoods	Std. cords	1,830	1,815	119	15
Hardwoods	Std. cords	10,187	9,283	719	904
Total	Std. cords	12,017	11,098	838	919
Poles:					
Softwoods	M. pieces	62	62	186	--
Hardwoods	M. pieces	--	--	--	--
Total	M. pieces	62	62	186	
Mine Timbers, etc.:					
Softwoods	M. cu. ft.	12	12	12	--
Hardwoods	M. cu. ft.	487	487	487	--
Total	M. cu. ft.	499	499	499	--
Miscellaneous Industrial wood:†					
Softwoods	M. cu. ft.	39	39	39	--
Hardwoods	M. cu. ft.	8,991	8,991	8,991	-
Total	M. cu. ft.	9,030	9,030	9,030	--
Posts:					
Softwoods	M. pieces	1,027	1,027	789	--
Hardwoods	M. pieces	15,256	15,256	8,786	--
Total	M. pieces	16,283	16,283	9,575	
Fuelwood:					
Softwoods	Std. cords	12,000	2,227	160	9,773
Hardwoods	Std. cords	1,095,000	922,866	61,677	172,134
Total	Std. cords	1,107,000	925,093	61,837	181,907
All products:					
Softwoods	M. cu. ft.	6,122	5,419	5,419	703
Hardwoods	M. cu. ft.	142,572	130,997	130,997	11,575
Total	M. cu. ft.	148,694	136,416	136,416	12,278

* International 1/4-inch rule.

† Charcoal, excelsior wood, farm timbers, hewn ties, etc.

Table 40. -- *Total output of roundwood by source and species class, Missouri, 1958*

(In thousand cubic feet)

Source	All species	Softwoods	Hardwoods
Growing stock trees: *			
Sawtimber trees	57,187	4,507	52,680
Poletimber trees	15,860	565	15,295
Total	73,047	5,072	67,975
Cull trees*	17,466	43	17,423
Salvable dead trees*	10,807	75	10,732
Other sources†	35,096	229	34,867
All sources	136,416	5,419	130,997

* On commercial forest land.

† Includes material from noncommercial forest land, nonforest land such as fence rows, trees less than 5.0 inches in diameter, and tree tops and limbs.

Table 41. -- *Volume of plant residues from primary industries, type of residue and species class, Missouri, 1958*

(In thousand cubic feet)

Industry	Species and character of residues								
	All species			Softwoods			Hardwoods		
	Total	Coarse*	Fine†	Total	Coarse*	Fine†	Total	Coarse*	Fine†
Lumber industry	8,379	4,180	4,199	736	331	405	7,643	3,849	3,794
Veneer industry	205	7	198	--	--	--	205	7	198
Cooperage industry	369	178	191	--	--	--	369	178	191
Other	213	9	204	--	--	--	213	9	204
All primary industries	9,166	4,374	4,792	736	331	405	8,430	4,043	4,387

* Unused material suitable for chipping such as slabs, edgings and veneer cores.

† Unused material not suitable for chipping, such as sawdust and shavings.

Table 42. -- *Timber growth projections, Missouri, 1959 to 1989**

GROWING STOCK

(In thousand cubic feet)

Period	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1959 (year of inventory)	78	5	73	242	19	223
1969 (plus 10 years)	95	10	85	322	26	296
1979 (plus 20 years)	110	15	95	436	34	402
1989 (plus 30 years)	120	15	105	602	46	556

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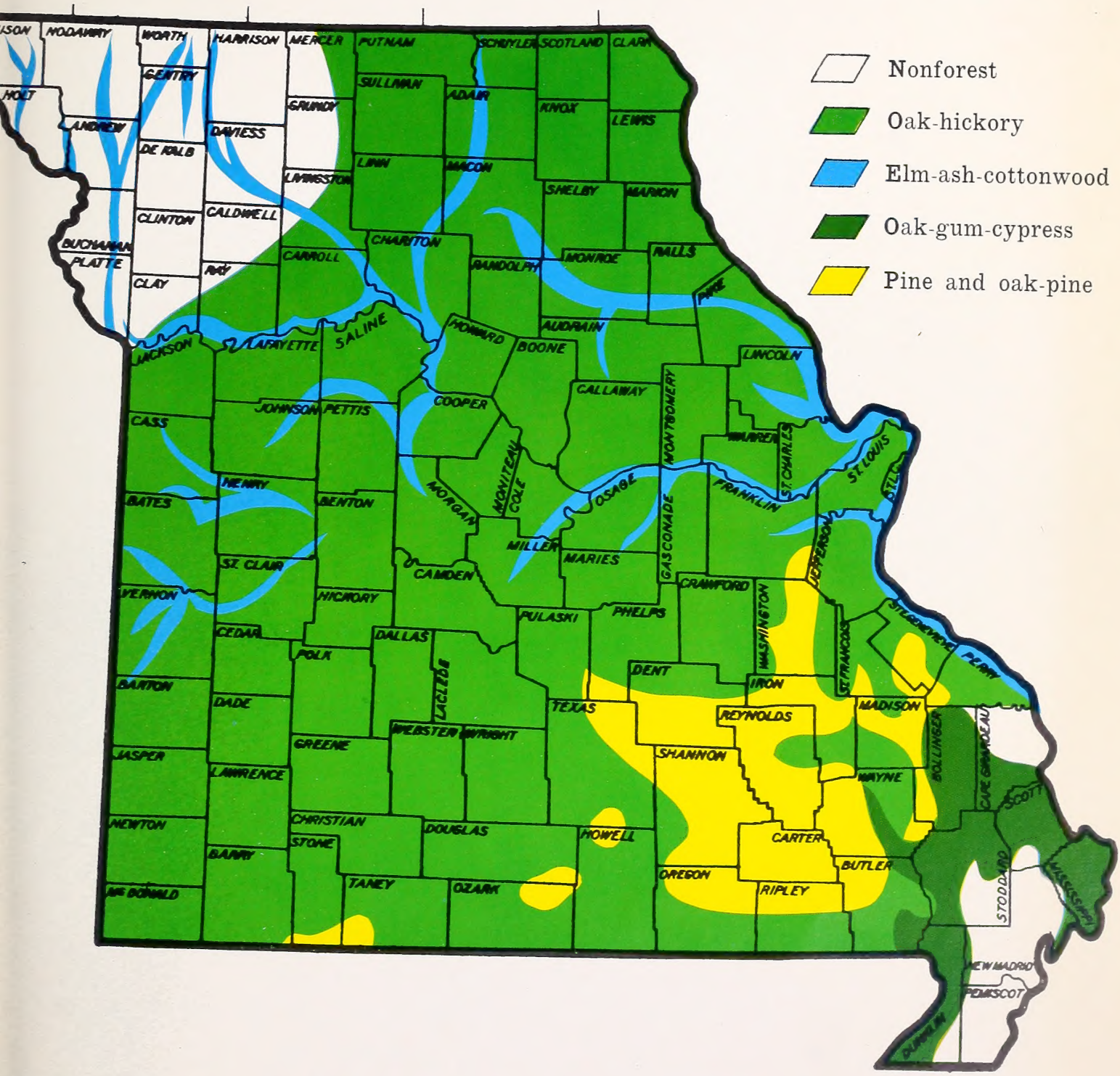
(In million board feet)†

1959 (year of inventory)	364	23	341	758	73	685
1969 (plus 10 years)	450	50	400	974	106	868
1979 (plus 20 years)	520	60	460	1,277	153	1,124
1989 (plus 30 years)	600	65	535	1,732	238	1,494

* The outlook for timber volumes and net growth to 1989 is based on assumptions that: (1) The annual timber products in the United States and Missouri will rise with estimated increases in population and national income, (2) wood will maintain its relative position in the national economy, (3) forestry will continue to advance at the rate indicated by recent trends, and (4) Missouri's proportion of the wood market will increase somewhat. The assumed trends anticipate continuing reforestation, "thickening up" of natural stands, improved cutting practices and forest management, and other changes leading to a more productive forest resource.

† International 1/4-inch rule.

Forest Types of Missouri



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